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Scientific Review
AND
SCIENTIFIC AND LITERARY REVIEW,
A RECORD OF PROGRESS IN ARTS, INDUSTRY, AND MANUFACTURES,
INCORPORATING THE
Journal of the Inventors' Institute.

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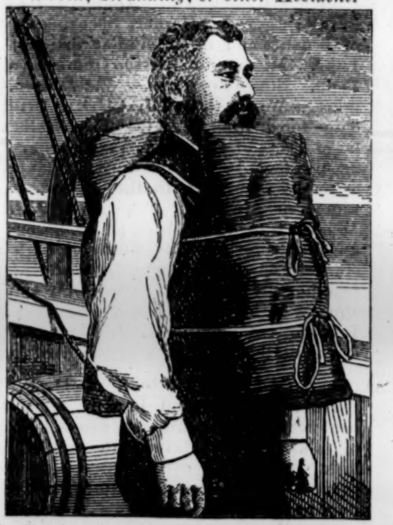

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(*Continued on page* 78).

SCIENTIFIC REVIEW
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A RECORD OF PROGRESS IN
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INCORPORATING THE
JOURNAL OF THE INVENTORS' INSTITUTE.

MAY 1, 1876.

SAFETY IN EXPLOSION.

Thrilling narratives are from time to time presented to us, by the public press, of dire accidents caused by explosive agents, oftentimes gunpowder; but sometimes nitro-glycerine, dynamite, and so forth, which, in their swift, resistless energy, bear about the same relation to gunpowder that, as regards travelling, the fast railway train does to the old stage coach; but although we are by such narratives warned of the necessity for extreme caution and carefulness in dealing with these mighty powers, yet we still find men whose business requires the use of them neglecting the most simple and obvious precautions, jeopardising not only their own lives but those of others, and from this neglect results such dreadful catastrophes as that which recently occurred in a railway tunnel which is in course of construction at Cymmer, near Neath, in Glamorganshire, for the purpose of connecting the Maesteg and Glyncorowg Railways. The work is being done by the Diamond Rock Boring Company, under the management of Major Beaumont, and the tunnel is being driven through very hard limestone rock. It seems that at present the mountain has not been pierced to any depth, the brickwork being described as reaching for some 150 feet, while the heading or rough excavation beyond stretches some 50 feet further. The method was adopted for penetrating the cliff of drilling holes into the face of the rock, and lodging there charges of dynamite, which are exploded by a time fuze. After the explosion has taken place the shattered fragments of rock are cleared away, and as the heading progresses it is arched and lined with masonry. The dynamite and gun-cotton required for the operation were, we are told, stored in a man-hole or recess in the wall of the completed tunnel, situated some hundred yards or thereabouts from its entrance; and on Saturday afternoon, when the catastrophe occurred, there were in this extemporary magazine some hundred and fifty pounds of dynamite and about ten pounds of gun-cotton. The work was going on briskly, a number of men being occupied in drilling the face of the rock, when suddenly a most terrific explosion took place, the noise of which, it is said, was heard twenty miles off. Sixty yards of the tunnelling were completely wrecked; massive beams of timber used to support the new roof were whirled this way and that like straws before the wind, and when the excavation was searched thirteen men were found dead and horribly mutilated, while several more were dug out alive, but so shockingly injured as to leave but slight hope for recovery. The only wonder is, says the *Daily Telegraph*, whose pertinent remarks on the accident we quote, that so much as a solitary survivor was left to tell the tale.

The inquest which has been opened in due course stands at present adjourned for a week in order to obtain, if possible, the evidence of two of the survivors. It is said that one of the men was seen to strike a match close to the magazine immediately before the accident, and that the "primers," or detonating fuzes used for firing the dynamite in the drill-holes, were stored in the magazine, together with the dynamite itself—a carelessness only comparable to that of leaving a loaded gun lying in a window-seat at full cock upon a hair-trigger. According to another account, a candle was stuck to the side of the magazine in a rough socket fashioned out of a lump of wet clay, and so, not unnaturally, fell down amongst the explosive materials lying beneath. It would be wrong, of course, to anticipate either the evidence to which the Coroner's jury will have to listen, or the conclusion at which they may ultimately feel it their duty to arrive. If, however, it be correct that, as Major Beaumont states, the only explosives in the works at the time of the catastrophe were some 150lb. of dynamite, together with a comparatively small quantity of gun-cotton, we are enabled at once to see that somewhere or other there must have been the grossest and most culpable negligence. Unlike gunpowder, dynamite and gun-cotton explode from percussion alone, and it is a common experiment for a man to take a piece of gun-cotton in the palm of his hand and apply a light to it, when all that occurs is a flash of flame and a slight whiff of smoke. If, however, he were to place a pellet of gun-cotton in the palm of one hand with a percussion cap or detonator of some kind on the top of it, and so strike it smartly with the other hand, there would in all probability be little left of him to tell what had taken place. Dynamite, as far as can be made out, obeys somewhat similar laws, being a compound of nitro-glycerine and sand, standing to nitro-glycerine itself in much the same relation as that which a mixture of gunpowder and sawdust bears to gunpowder. What happens when a spark is thrown upon a heap of gunpowder we all know; if, however, a red-hot coal is thrown on to a heap of gunpowder mixed with sawdust it simply splutters a little and dies out. Similarly, dynamite, or ordinary sand soaked with nitro-glycerine is a pasty, puttylike composition to which a light can be applied with impunity. Under extreme provocation it will fire and burn away; but even then it does so with much less energy than that displayed by an ordinary squib. When, however, it is fired by percussion or detonation, it explodes with a violence which experts calculate to be rather more than six times that of the best pebble-gunpowder, weight for weight. This being so, we may roughly estimate that the effect produced in the Cymmer Tunnel must have been equivalent to that which would have been produced by the explosion of about half a ton of gunpowder It is melancholy to think that the accident would, in all human probability, never have occurred at all if the detonators or percussion fuzes had not been stored up in the same magazine with the dynamite itself. A spark from a miner's pipe or even a lighted candle falling upon a heap of this material would, as we have already said, do no manner of harm. Dynamite, in short, so long as care is taken not to explode it by percussion, is infinitely safer than ordinary gunpowder.

Doubtless this accident will cause more reluctance to use these explosive agents. However, for various purposes, and for mining more especially, powerful explosives are indispensable. Nothing is impossible for science, and some means ought to be found to enable us to carry and store nitro-glycerine, or even more violent compounds, with practical safety. Unfortunately, we are at present passing through a stage of panic, although the terror which exists is, undoubtedly, to a great extent, justified by the facts. We treat gunpowder as though no more precautions were needed for handling it than if it were so much sawdust; while our dread of nitro-glycerine and dynamite is almost irrational. As our chemical knowledge increases we shall better understand how to manage and control the latent forces that lie locked-up in these strange compounds, like the gigantic genie whom the fisherman in the "Arabian Nights" finds hidden in the bottle. At present, all that can be said is that every precaution we take, even if erring on the side of strictness, can be justified by the too frequent occurrence of catastrophes such as that which has taken place in the Cymmer Tunnel.

Reviews.

DR. PAGE'S PHYSICAL GEOGRAPHY.

"Introductory Text-Book of Physical Geography." By D. PAGE, LL.D., F.G.S., &c. Eighth Edition. William Blackwood and Sons, Edinburgh and London. 1876.

THIS is the eighth edition of Dr. Page's "Introductory Text-Book of Physical Geography," published with the idea of conveying in a simple but systematic manner the leading facts of the science to which it relates. The learner is not troubled with a mass of details which it is impossible for him to remember, nor deterred from the study of a most interesting and important branch of knowledge by an array of astronomical, geological, and meteorological data, which, while they bear but distantly on his subject, are altogether unneeded at this stage of his progress. Although, as the author observes, even in its simplest form the science of Physical Geography is by no means a child's study, and the comprehension of its truths will be greatly assisted by a previous acquaintance with the elements of General Geography. Under this conviction Dr. Page aimed at producing a *Text* not a *Task* book—a thing to be read and reasoned over, and not a compilation of unconnected facts to be irksomely and uselessly committed to memory.

In the present edition the revision embraces all that is important in recent discovery, the original textual arrangement being so little disturbed, that no inconvenience can be felt in using it for class-purposes along with any of the more recent editions.

DR. CROMBIE ON INDUCTION OF SLEEP AND INSENSIBILITY TO PAIN.

"The Induction of Sleep and Insensibility to Pain by the Safe Self-Administration of Anæsthetics." By JOHN M. CROMBIE, M.A., M.D., Late Resident Medical Officer, Cancer Hospital; Fellow of the Medical Society of London, &c. Second Edition. London: J. and A. Churchill, New Burlington Street. 1876.

THE important subject treated of in this pamphlet, although falling strictly within the province of medical science, is of such widespreading interest, that we gladly present our readers with a brief notice of it. The great object of the work is to advocate the use of what the author affirms to be safe and easy means and appliances for the self-administration of anæsthetics, which he thus refers to:—

The apparatus I have devised for the self-administration of anæsthetics permits the patient to put himself asleep, while a dangerous overdose is impossible, in consequence of the principle on which the supply of the anæsthetic depends. An india-rubber air-ball, communicating through a tube with the air inside the chloroform bottle, when compressed by the patient's hand causes the expulsion of a little chloroform vapour through another tube dipping into it. This is received into a conical inhaler placed conveniently for inhalation by the patient. The compression of the ball being at the will of the patient, without which no chloroform vapour can possbly reach him, so is the anæsthetic condition of atmosphere which he inhales; and as a single compression makes only a feeble alteration, the patient can accommodate this chloroform atmosphere to his capacity for respiring it, a condition of paramount importance to its agreeable and safe inhalation. All that is requisite is simply to provoke sleep, that is, to produce the tendency to sleep; and when this has been effected, there is a strong instinctive inclination to cease all movements, which the patient is naturally not disposed to resist, and consequently discontinues the further compression of the ball. Besides this, there is a physical impossibility of taking too much, because the voluntary muscles become paralysed, that is, incapable of any movement when sleep begins to supervene; and as a matter of course, no more chloroform can be inhaled by this method of administration. When all conditions favouring sleep are observed, that is, when the patient is in bed, comfortably warm and excluded from noise and too much light, and wearily longing for sleep, even although suffering great pain, an incredibly small quantity of chloroform is sufficient to produce it. For the simple induction of insensibility to pain a still less quantity is requisite, although repetition may sooner be necessary.

Besides extending the clinical use of chloroform, the instrument will be found useful when the agent has to be exhibited at obstetrical operations, when it is exceedingly difficult and harassing for one person, as in the country is often necessarily the case, to attend to the operation and superintend the administration at the same time. At surgical operations, also, especially for children, it may be used with advantage by the chloroformist, as it supplies a means of slowly increasing the chloroform atmosphere as the patient gets used to it, and afterwards of maintaining it of the same quality; the quantity of chloroform vapour passed into the inhaler, which of course does not need to be removed, being always as nearly as possible the same, and subject to exact regulation.

Mr. Macnamara has pointed out to me how the apparatus may be advantageously used for the application of chloroform vapour as a local sedative to painful wounds, such as ulcers and open cancer sores. In India he has employed the vapour in this way with great benefit, but his difficulty was in preventing the anæsthetic in the fluid state from reaching the wound, in which case severe pain would be produced. With this apparatus such an accident cannot happen, while the vapour can be applied continuously and straight down on to the surface of the wound.

It is well worth the consideration of all who have to deal with the long suffering arising from such diseases, where any new expedient to foil the ingenuity of pain must surely be welcome.

A few whiffs of chloroform vapour directed into the cavity of a painful tooth is sometimes effective in affording relief, and for this purpose the pointed shape of the chloroform tube in this apparatus presents the proper facility.

There can be no doubt that the local use of the anæsthetics in this diluted form has wide clinical application, for although as M. Claude Bernard, in his recent work on "Anæsthetics," justly remarks, there is no such thing as local anæsthesia in the sense of entirely depriving a part of all feeling, this is a very different thing from the purpose aimed at by local sedatives, whose use and value have been recognised on all hands *ab ovo mundi.*

PRESTWICH ON WATER SUPPLY.

"On the Geological Conditions affecting the Water Supply to Houses and Towns, with special reference to the Modes of supplying Oxford: being a Lecture given on October 22, 1875, with Additional Notes." By JOSEPH PRESTWICH, M.A., F.R.S., F.G.S., F.C.S., Assoc. Inst. C.E., &c.; Professor of Geology in the University of Oxford. Oxford and London: James Parker and Co. 1876.

THIS pamphlet, although specially devoted to the question of Oxford water supply, by no means limits the matter to that town, but goes into the whole subject in a way well worthy of attention from all sanitarians, and we give the following extract as fully illustrating this. Referring to the effect of drawing water from permeable strata into which drainage is so frequently discharged, he says: Fortunately, objectionable as the practice is, as was that of turning the sewage of our large towns into our rivers (a practice happily now in course of being remedied), the results, except in extreme cases, are not so serious as might at first sight be anticipated. Without some counteracting principle, it would, in fact, be difficult to find pure water in any civilised part of the world. The counteracting agent on underground water is the wonderful power of oxidation and absorption possessed by the soil, and, on surface-waters by the air and light. By the action of these agents the noxious organic matter is destroyed and converted wholly, or in greater part, into innocuous substances, as effectually, as by the process of fermentation, sugar is resolved into carbonic acid gas and alcohol, so that, when the process is complete, not a trace of sugar is to be detected in the resultant liquid. But just as some incompleteness in the fermentation may leave a portion of free sugar, so insufficient oxidation will allow a portion of the organic matter to remain. In wells this will depend upon the thickness of the strata through which the drainage has to pass, on the quantity of sewage, and on the length of time it has been in operation; just as in rivers it depends on the length of their course, their volume, and their velocity.

It would take too long now for me to dwell more on this subject, but I may give you some of the conclusions that have been obtained, and indicate the limits to this remarkable provision of nature.

Water, in passing from the surface through the soil, sand, gravel, or rock, takes up soluble inorganic or mineral matter, together with organic matter; but while the former is unaffected, or rather increases, by continued filtration through the ground, the latter is sensibly diminished, or even, when the extent of filtration is sufficiently great, altogether destroyed and removed,—the change being effected by the combination of the injurious nitrogenous compounds with oxygen, and of the resultant acids with the alkalies of the soil, whereby the nitrates and nitrites of soda and potash, which, in the small quantities in which they occur are perfectly harmless, are formed. It has, for example, been found that the Thames waters, which at their point of intake for the supply of London contain 1 to 2 grains per gallon of organic matter, lose, by filtration through artificial beds of sand and gravel, from one-fourth to two-thirds of that quantity. Such being the case with a small artificial layer of sand, you may judge how much greater the effect will be when the water passes through many feet, and sometimes hundreds of feet, of permeable strata.

With regard to surface-waters, the incessant motion to which they are subject as they flow down streams and rivers, causes a free absorption of air, the oxygen of which acts on the organic matter in the water, converting it into carbonic acid and other gaseous products, which escape and are lost in the atmosphere, or are absorbed by vegetation, or combine to form other innocuous products. Thus, for example, it has been found that the Thames water contains more organic nitrogen at Lechlade than just above Oxford; less again at Abingdon; more below Reading, and then a decrease to the Oxford standard at Windsor; while at Hampton the river was found to be "chemically purer than at any other part of its course."

It is necessary to remember, therefore, that, within certain limits, these natural agencies act as a sufficient safeguard against our ignorance and carelessness. But these agencies have, after all, their limits. The stream may be overcharged, and the filter may become clogged with impurities in the course of time, and that which sufficed for a new or a small population becomes entirely insufficient when the population increases, or has been too long established. The difficulty is where to draw the line—to say how far we may go, and where we should stop.

The evil is one which did not altogether escape the attention of our predecessors. Oxford, like most other towns, was for ages chiefly dependent on shallow wells' supply. Two centuries and a-half ago (1610), however, Otho Nicholson, of Christ Church, in order to obtain a better supply of drinking-water for some of the colleges, had a small perennial spring which issues at the base of the Coralline Oolite on the hills above North Hincksey, carried by pipes to Oxford, a distance of two miles across the valley of the Isis. He also erected a fountain for public use at Carfax Cross. The supply may have been small, and the water hard, but it was, I apprehend, far purer than that furnished by the wells. The work was a most creditable and useful one, and it is to be regretted that, when, towards the end of the last century (1787), it was considered necessary to remove the Cross, the fountain was also done away with, and, more lately, the supply has been altogether cut off. Are there not sufficient reasons of hygiene and art for its restoration in some other more open part of the city? I understand that the spring still yields about 10,000 gallons daily, and might, I am satisfied, be very greatly increased, by extending the collecting-ground. It would, at all events, afford a moderate supply of good and safe drinking water; and it would be easy to reduce its hardness by Clark's process.

DAY'S ELECTRIC AND MAGNETIC MEASUREMENT.

"Exercises in Electrical and Magnetic Measurement, with Answers." By R. E. DAY, M.A. London: Longmans, Green, and Co. 1876.

THE author states in his preface that in the composition of this little book he has endeavoured to arrange in a systematic form a collection of exercises in electrical and magnetic measurement for the use of students in general, and more especially for those who are commencing a course of laboratory practice, or are preparing for actual work in connection with electric telegraphy. He sought to lay before the student, under the form of problems, short descriptions of a series of experiments illustrating the fundamental laws of electricity and magnetism, and the various methods of executing measurements in the laboratory and testing-room.

It is now universally admitted that numerical exercises are necessary in the study of the experimental sciences, both as giving practice in the application of the various theories and as affording tests of ability to comprehend as well as apply that which has been learned. A thorough grasp and realization of the meaning of a formula in physics can scarcely be acquired from lectures, or from seeing it in a text-book, whereas the working out by the student himself of its application to a single concrete case is often sufficient to make him feel confidence in using it, and to give precision to ideas which would otherwise remain floating in his mind in a vague and comparatively useless form.

In these problems I have (says the author) almost exclusively employed the nomenclature and the system of units recommended by the committee of the British Association; since, from their being in constant use among practical electricians, it is very desirable that their knowledge should be more generally diffused.

It is important that the student should thoroughly understand the various systems of units adopted by British and foreign physicists, and be able to convert a result expressed in any one system to its equivalent in any other. Several of the chapters are therefore commenced with exercises bearing upon this point.

Thanks are tendered to Professor Clerk Maxwell for valuable advice received during the preparation of the book, and to Professor Everett for his permission to make use of his "Illustrations of the C.G.S. System of Units."

Most of the exercises are based upon experimental work performed in the laboratory of King's College, under the direction of Professor Adams, to whom the author tenders his best thanks for much sound instruction in the principles of physical science.

We can conscientiously commend this work to our readers as one well worthy of study.

DR. LARDNER'S HANDBOOK OF ASTRONOMY.

"Handbook of Astronomy." By DIONYSIUS LARDNER, D.C.L. Fourth Edition, Revised and Edited by EDWIN DUNKIN, F.R.A.S. (Lockwood and Co.)

THIS fourth edition of Dr. Lardner's well-known work differs from those previously prepared by him, chiefly in consequence of the alterations made necessary by the continued progress of astronomical discovery, which is now well nigh overwhelming.

MORRIS'S GEOLOGY.

"Series of Large Geological Diagrams, with Explanatory Notes on Geology." By Professor JOHN MORRIS, F.G.S., University College, London. London: Jas. Reynolds, Strand.

MR. JAMES REYNOLDS has brought out a number of educational diagrams, for some of which he received the prize of the International Exhibition, 1862. The present number is $1\frac{3}{4}$ feet in length. The section of the earth's crust is the first diagram, and it and the others are very prettily coloured. The different formations are shown against a background of hill and wood-plain, which is not coloured. The explanation at the foot goes into the subject in an elaborate way, giving the divisions and sub-divisions. The diagrams are on very thick paper, and one unfolds to a length of five or six feet. Professor Morris says:—"In looking at the section, it will be perceived that the granite and older rocks are represented on the left, and gradually overlaid by the newer ones towards the right, just as the reader, in consulting a geological map, will find the older formations constitute the western part of England and Wales; and, in traversing the country towards London, will successively pass over many of the sand strata, as shown in the section, until arriving at newest-formed in eastern counties."

The notes are simplified by the different formations, and minerals being indicated by large type like the subjects in Watt's Dictionary of Chemistry. Of the other diagrams, one of the most beautiful is the section of the London basin. The strata of the basin consists of permeable and retentive materials, which allay or prevent the free passage of water. To the permeable beds belong the gravels, the Woolwich beds and Thanet sands; London clay and gault the retentive. The series embraces astronomy and other sciences, and would be useful to civil engineers.

McBEAN'S ENGLAND AND INDIA.

"England, Palestine, Egypt, and India connected by a Railway System, with Maps." By S. McBEAN. W. H. Allen and Co., 13, Waterloo-place, Pall Mall.

THE author of this book asserts that it would be advantageous to connect Bombay with London by railway, at a cost of £61,000,000, the time consumed being only eight days. The British Government must construct, at its own cost, the proposed line from Scutari to Kurrachee. Their trains are to start from Calcutta for Pekin. The distance to Bombay is set down at 6,153 miles.

The author argues that the inauguration of the railway would stop any designs of Russia upon the Holy Land, and be beforehand with their hordes at Peshawur. Besides, the advantages accruing to this country, the sad misrule and misgovernment under which rich and fertile countries on the way are groaning, would give place through the opening up of a railway to ultimate peace and plenty.

This work is written with a great deal of fair reasoning and considerable ability, and is superior to the mass of information on the subject.

PHILIP'S CHART OF SUEZ CANAL.

"Philip's Chart of the Suez Canal," with Explanatory Notes. By JOHN BARTHOLOMEW, F.R.G.S. George Philip and Son, 32, Fleet-street.

THIS is a nice little map, arranged like a pamphlet—the printed matter being on the back. The exterior bears a small representation of a portion of Egypt, &c., constituting part of the interior. The map shows the Suez Canal from Port Said to the Great Bitter Lake, and on to the Red Sea, with telegraphs, lights, quarantines, and mileage. Two corner charts show the Mediterranean entrance and the one at the Red Sea, and another the approaches to the Suez Canal, taking in most of the European countries. The pamphlet is a complete history. Great praise is given to M. Lesseps. The view of the writer may be pithily quoted. The opportunity is now granted to England to make it her boast, also, that henceforth, with God's help, she protects and enlarges the benefit of the truly international canal for the "good of all nationalities." We appear to have derived great benefit in the matter of the importation of tea.

There are very heavy cuttings in the course of the canal, the first one being the plateau of El Guisr, the sand-hills having been forty feet high, and four miles are cut through lime or sand-stone, the engineers following the softest part of the rock. There is a very pretty description of the town of Ismalia, which has sprung up in the desert—in the centre of the canal—a most flourishing place, the capital of a newly-peopled province. We may say that our readers will find in this little publication as intelligent and full a guide-book as many of the large volumes which are published, though there are but seven pages of print.

ON WATER ECONOMY.

By GEO. J. SYMONS, SECRETARY TO THE METEOROLOGICAL SOCIETY.

THE following is the substance of Mr. Symons's paper, recently read at the Institution of Civil Engineers:—

In 1875, the number as well as the volume of the floods was unusual. They were prevalent in many parts of England and Wales during the whole of the latter part of the year, especially in July and November.

The first flood, on the 15th of July, was the result of a rainfall of large amount and duration. The rain lasted on an average about thirty hours, but in most localities 90 or more per cent. of the amount fell in twenty-four hours, and at some stations all fell in twenty-four hours. This flood was chiefly confined to the West of England, and its effects were most serious in Monmouthshire and South Wales, where at many stations the rainfall on the 15th of July was nearly twice as great as the amount previously recorded at those places. Generally heavy summer rains occur in thunder storms, but the July rain in Monmouthshire and South Wales was not of this type, and was quite as remarkable for its steady persistent rate, of about 1 inch in each of five successive periods of five hours, as for the total quantity. To give a general idea of this rainfall in Monmouthshire and South Wales, a few stations were mentioned at which the depth exceeded 4 inches. Thus it was at Tintern Abbey, Monmouth, 5·91 inches; at

Springfield, Newport, 5·45 inches; at Tynant Radyr, Glamorgan, 5·10 inches; at The Cemetery, Cardiff, 5·05 inches; and at Ely, Cardiff, 5·02 inches. The damage caused by this flood was considerable. The Avon and Frome overflowed their banks; at Cinderford, Gloucester, a reservoir burst and flooded two or more mines; at Monmouth a reservoir burst, and numerous bridges were swept away; and the traffic on the greater number of the Monmouthshire and Glamorganshire railways was interrupted.

From the 16th to the 18th of July heavy rain fell in various parts of the east of England and the midland counties, but with no very exceptional amounts, the largest reported being near Louth, 1·36 inch, and at Halifax, 1·18 inch. The districts visited by these rains had, however, previously been nearly saturated by those of the 14th to the 16th, consequently the results were very serious, especially in Staffordshire and the adjoining counties. In fact, throughout the Midlands much damage was done, and many towns were inundated, including Northampton, Huntingdon, St. Ives, Burton-on-Trent, Kidderminster, Coventry, Nuneaton, &c.; a canal burst near Tamworth, and railway traffic was stopped on several lines.

Although during August and September several floods occurred, doing considerable local damage, they were quite eclipsed by the much larger and more general ones of July, October and November. On October the 9th, a heavy fall of rain occurred over central England, especially in the dry district extending north-east from Banbury towards Northampton. The depth of rain at Banbury, and at stations above it in the valley of the Cherwell, was 3 inches or upwards, consequently that river was excessively flooded, as was also the Avon, both at Stratford-on-Avon and at Evesham. During the next nine days there was occasional slight rain, amounting altogether to about ½ inch, which was just sufficient to prolong the discharge of the above flood. Much land was therefore under water, and most of the rivers of central England were fuller than usual on the 18th of October, when another heavy fall of rain commenced, which lasted through the 19th and part of the 20th. During this time, upwards of 3 inches of rain fell over part of Staffordshire; and at Exeter 3·26 inches descended in a few hours, which produced much local but no general damage. It was far otherwise in the great Midland tract, which had received upwards of 2 inches depth of rain. The ground being saturated, or nearly so, all the low-lying lands were flooded, and the total area under water was probably greater than it had been since 1852.

Some idea of the exceptional nature of the floods of 1875 might be gathered from the observations made on the height of the Avon, at Stratford-on-Avon. Since 1800 there had been only ten floods exceeding the height of 4 feet above the weir, and four of these were in 1875, in which year alone more than one flood had reached over 4 feet. Observations at Evesham, 16 miles lower down the river, gave nearly the same results, the slight difference probably being due to the tributaries which the Avon received between the two towns.

The enormous amount of damage and loss caused by these floods, suggested forcibly the question, "Can future floods be abated?" either by embanking, constructing storage reservoirs, or lowering the water level. There was a prevailing popular demand that the flood waters of the upper Thames should be stored, but probably those who urged this did not realise the enormous amount of water to be dealt with. The reservoir storage adequate to prevent floods on this river would have to be at least 160,000,000,000 gallons, and owing to the Thames valley being singularly destitute of good natural sites for reservoirs, their construction of adequate capacity would cost at least £15,000,000 sterling; this probably was a sufficient reply to the suggestion of storage regarded solely as a remedial measure against floods.

Considering that the health of the nation depended on the purity of its water supply, and considering the multitude of uses of water for manufacturing purposes, and the great pecuniary loss resulting from floods, it seemed remarkable that there was in England no central body charged with the supervision and control of so important a matter. It was believed that had a central department existed to receive information of the depth of the rainfalls, and with power to telegraph the information to local officers, having the sluices, &c., under their absolute control, much of the recent damage might have been averted.

The quantity and quality of water were so frequently discussed together, that a few words upon the latter question might not be out of place. The purity of water supplied for drinking purposes was of the highest importance, but the extreme refinement of modern analysis had seemingly led chemists to set up a standard of purity in excess of the necessities of the case, for every source of supply, even deep well-water and mountain streams, had been objected to on some ground. Everyone engaged in selecting a source of water supply looked out for the best obtainable at a reasonable cost; it could scarcely be expected that more should be done. Of the total supply probably not one-hundredth part was drunk, and not one-thousand part cold and unmixed with other ingredients. It was hard that nine hundred and ninety-nine parts must be of ideal purity for the other one that might be drunk, especially considering that the better class of domestic filters would remove everything injurious.

DUCKHAM'S HIGH PRESSURE GAS REGULATORS.

At the Inventors' Institute meeting on 23rd March, 1876, a paper on Mr. Duckham's invention for high pressure gas regulators was read, on behalf of Mr. Duckham, by Mr. F. W. Campin, the Secretary of the Institute.

The paper commenced by referring to the imperfections of the present system of lighting the interior of railway carriages by the regulation lamps, and then proceeded as follows:—

The public and the newspapers have, upon several occasions, alluded to this subject with surprise that something better than the plan now used should not long since have been supplied for the comfort of the passengers, or have been endeavoured to be applied to satisfy the numerous and almost incessant demands of travellers by all the railways.

They (the railway companies) are aware of the remedy, "gas"—compressed gas; and if the directors or the shareholders and the public were to at all bestir themselves in the matter, the whole of our long railway journeys would be pleasant transits, instead of the monotonously dull affairs that they now are.

I shall have to explain the action of these inventions to you, and in doing so shall have also to draw your attention, not only to the pleasure of having a brilliantly and nicely-lighted carriage to travel in, but that the railway companies, while obliging their travellers with this boon, will, at the same time, be effecting a saving of at least 50 per cent. in the cost of lighting their carriages.

In exhibiting these inventions, you will see the small space in which gas can be stored or compressed, returning again to its original volume when permitted to flow through the regulator to the burners, increasing in its illuminating power by about 2½ per cent., and thereby giving a more brilliant light and allowing the carriages to travel for many hours without any replenishing.

The principle of Mr. Duckham's first patent has been for over two years extensively used upon the German lines of railways (Mr. Duckham having omitted to take out patents for Germany), and it is stated that over 500 railway carriages are lighted upon this system, and with a saving of about 70 per cent. upon the use of oil is effected.

Mr. Duckham's patent is dated June 23rd, 1869, and it appears is the first patent taken out that ever attempted to control gas at pressures up to 150 lbs. to the square inch or ten atmospheres, by which means carriages can be made to carry sufficient gas to last, if required, thirty hours.

The Midland Railway adopted the principle upon fifty-two of their metropolitan carriages, and, as the testimonial proves, with complete success; but after two and a-half years, upon the appointment of a gas superintendent, and during the period that a carriage was being fitted by his desire to run for thirty hours, permission was obtained from the Locomotive Committee to change the carriages into the principle of gas bags on the roof, by which means they could only travel to St. Alban's instead of, as previously, to Bedford.

Here I cannot do better than describe succinctly the main features of the first patent taken out, and for that purpose will refer to the description in the specification of Mr. Duckham's patent.

The invention (he says) relates to improvements in gas regulators, and is more especially applicable for regulating the supply of gas to the burners of railway carriages, and in other cases in which the gas is stored under high and varying pressures. The regulator consists of a valve carried on a lever arm hinged at one end near the orifice at which the gas arrives, and connected at the other to the centre of an india-rubber or other diaphragm, the whole being contained within a suitable air-tight casing. The valve may either be formed of a spherical or other shaped part projecting from a lever arm near its fulcrum, and received in a suitable socket or seat when the valve is closed, or it may be formed simply by the surface of the lever arm abutting against the orifice in the nozzle at which the gas arrives for the purpose of closing the same. The apparatus is contained in a suitable casing as before mentioned, from which the gas is conducted to the burners as usual. Should the pressure of the gas be great or small in proportion to the rate of consumption the valve will be partially closed or opened as the case may be, until a suitable pressure is attained. This is effected automatically by the increase or diminution of pressure on the diaphragm of the gas passing through the apparatus, the diaphragm as before mentioned being connected to the end of the lever arm. The relative positions of the valve and diaphragm may be adjusted permanently by means of a set screw connecting the lever arm with the diaphragm.

Subsequent to this patent, which did not allow of the gas being under the control of the guard or authorized officer, so as to permit of the officer lowering the gas, Mr. Duckham adopted further improvements, whereby he was enabled to control the gas, so as to permit of the gas being put full on or reduce same to minimum. This further improvement (also subject of a patent) are for the purpose of effecting a further saving of gas, and by its use the guard of the train can lower the gas to a minimum during the daylight; but when travelling through tunnels or at night time, allows a full flow of gas. And upon again emerging into daylight, reduces it as before, by which a large saving in the consumption of gas is obtained. As also an addition to the time a train can travel without a fresh supply of gas in the cylinders.

Independently of railway carriages, you will find that Mr. Duckham's patent has also been applied to lighting tram cars, the obnoxious oil used in which is not only very disagreeable, but highly injurious to passengers suffering from any complaint of the respirative organs, as some of the testimonials from medical practitioners attest.

The testimonial of the manager, and two letters of the secretary, of the London Street Tram Company, also testify to the brilliancy and steadiness of the light, even with the use of argand burners, the most delicate of all tests.

Beyond the lighting of railway carriages and tram cars, there are some other matters to which Mr. Duckham's invention has been applied with the view of using compressed gas, and amongst others, light-houses beacon lights, one application being at King's Lynn. On board ships, the only reason gas has not been used is the difficulty as to the manner in which to store it until used, and which can now be accomplished by compressing it, and then allowing it to flow through the compressed gas regulator.

In order to show the superiority of this system over that ordinarily used by the railway companies, I now proceed to show by detailed statements that considerable gain would accrue from the use of these regulators.

The cost of ordinary coal gas to a railway carriage with a 5 feet burner in each of the four compartments, to be in use 24 hours per day, per week, the cost at 3s. 9d. per thousand will be about 13s. 1½d.

Allowing one-third at least saving for pneumatic machine will be about 8s. 9d.

Or with 3 feet burners for the same period, about 7s. 6d.

And, as before, only allowing one-third, 5s. 5d.

The latter light would be about double the power of that now in use in railway carriages.

The use of rape oil (as compared with gas) as commonly used in railway carriages at 3s. 2d. per gallon, costs—2 quarts oil, cotton, waste, wicks, &c., burning 90 hours, 1s. 8¼d.

Cost of compressed gas by a 3 feet burner passing 2½ feet per hour, and consuming 225 feet of gas at 3s. 9d. per thousand, with increased illuminating power of 1¾ candles, 10⅛d.

Thus showing a saving in favour of gas of 50 per cent.

Example, as compared with the illuminating power of sperm candles :—

Oil, 2 quarts, at 90 hours, is equal to 275 candles; gas, 225 feet, at 90 hours, is equal to 450 candles.

The cost of lighting a railway carriage with oil for four lamps, burning 24 hours per day, is about per annum £34 8s.

Gas, using 3 feet burners, and use of pneumatic machine same time, about £14.

Saving per annum, £20 8s.

In taking into consideration the cost of gas as against oil, the cost of labour in changing lamps, the time lamps have to be lighted before required, the breakage of lamps, compensation claimed against the companies for clothes damaged by the spilling of oil, the waste of oil, and the disagreeable smells, should not be lost sight of.

Having thus shown the great saving of expense, I will now proceed to the description of the exhibits before you, and they will be pointed out by Mr. Mathews, Mr. Duckham's representative.

These exhibits comprise the stand with railway lamp, as fitted to the ceiling of a railway carriage; the glass opening upon a hinge to allow of the cleansing and lighting of lamp from the interior of the carriage.

The patent regulator (1869), as shown upon the table to control the pressure of the gas in the cylinder.

A high-pressure gauge to indicate the pressure of the gas in the cylinder under the table.

A water gauge to show the pressure of gas at the burners.

A model, showing the arrangement of the pneumatic apparatus, combined and contained within the case of the regulator, and which forms the patent, August 18th, 1875.

The probable cost of fitting up a railway carriage with the gas apparatus will be from £30 to 35 each, according to the number of lights and hours required to burn. This will be for coal gas; but for oil gas, considerably less, the cylinders not being required so large.

The probable cost of fitting up a tram car with gas apparatus in like manner will be from £12 to £17 10s.

The cost of lighting a tram car with two 2 feet burners will average through the year about 8d. per week.

Mr. H. A. F. Duckham's improved gas appliances were exhibited at the Society of Arts, in reply to circulur, June, 1874, for improved railway lamp or means of illumination, suitable for railway passenger carriages, comprising:—

A lamp, as fitted to the ceiling] of a railway carriage; the glass opening upon a hinge to allow of the cleansing and lighting of lamp from the interior of the carriage.

The patent regulator as shown upon the table to control the pressure of the gas in the cylinder.

Also a high-pressure gauge to indicate the pressure of gas in the said cylinder.

A water gauge to show the pressure of the gas at the burners. A pneumatic machine which enables the guard to have perfect control of the gas in each carriage, and to raise or lower the light as may be required. The advantage of this contrivance is considerable, inasmuch as it will effect a saving of above one-third in the consumption of gas by reducing the light on leaving a tunnel, or on the approach of daylight. This machine has never been hitherto publicly applied.

A section of the regulator.

The cost of gas with a 5 feet burner in use 24 hours per day, in each of the four compartments, per carriage per week, 13s. 1½d., allowing only one-third for pneumatic machine, 8s. 9d., or with 3 feet burners for same period, 7s. 6d.; also use of pneumatic machine 5s. 5d.

The latter light would be about double the power of that now in use in railway carriages.

The cost of fitting a railway carriage, exclusive of cylinder, will be for four lights, about £17 10s.

The expense of cylinders will depend upon the number of lights, and the length of time they would be required to burn.

One great advantage attends this patent: a perfectly steady and clear light under all circumstances, even with the use of argand burners. No amount of vibration affects the light.

It is well known that compressed gas has a greater illuminating power than non-compressed gas. The former gives a light of 14½ candles, and the latter only 13, as allowed by the present standard.

The carriages can be fitted to run twenty-five to thirty hours.

In the tram car which the London Street Tramway Company have had running for some months on this principle, with argand burners, the cost of gas is rather under 1s. per week, for two burners, consuming 3 feet each per hour. With 2 feet burners the cost would be about 8d.; and that would afford a better light than the disagreeable oil now in use.

This system was also successfully applied to fifty-two carriages for nearly three years on the Midland Railway.

It may be asked why it was discontinued. I would be both tedious and uninviting to go into these details; but the simple answer is that might triumphed over right. The public are perhaps unaware that not a step can be taken without opening the purse-strings. It was not who supplied the best article, but who was prepared to pay. The directors were totally in the dark as to the working cf this under-current.

I am in a position to prove that not only did my system succeed, but, further that it answered most satisfactorily, as the accompanying letters prove.

"Midland Railway Locomotive Department,
"Derby, July 11th, 1870.

"Dear Sir,—In reply to your letter of the 4th inst., I beg to say that at first your compressed gas regulators on the gas trains caused us a deal of trouble, in consequence of their being too weak, which you have since rectified, and they are now working very satisfactorily. The reason why none have been ordered lately is, that none have been required.—Yours truly,

"M. Kirtley,
"Per Geo. Mellor.

"Mr. H. A. F. Duckham."

"London Street Tramway Company,
"180, Great College Street, Camden Town.
"7th November, 1874.

"Sir,—In reply to your enquiry as to your compressed gas, I have much pleasure (in the absence of the secretary, Mr. J. B. Glenn), in testifying to its perfect success.

"The car that you fitted up with gas holders and regulator has now been running daily since the 22nd August last. It gives a beautiful light, which burns steadily; is not affected by the motion of the car; gives no smell whatever, either inside or outside the car; is perfectly under the control of the conductor; in fact, once lighted, burns for ten or eleven hours, without any further attention.—I am, sir, your obedient servant,

"W. Jaques, Traffic Manager.

"Mr. N. Bristow."

As regards the use of argand burners, it will be seen by the following extract from the *Standard* that argand burners can be used to gas lighting tram cars by Mr. Duckham's arrangements :—

"The London Street Tramway Company have specially adapted and fitted one of their new and very handsome cars with a patent apparatus (Duckham's) for lighting with gas, and a number of scientific and practical gentlemen were invited on the evening of August 17th, 1874, to witness this exceedingly successful invention. The car was run over the lines in the company's yard near the Red Cap, Camden-road, and stones and other impediments were placed on the metals to test the steadiness of the light. The burner is an argand of very improved structure, and burns steadily and beautifully. The invention is one which, it seems to us, must command a wide commercial use on account of its utility, simplicity, and effectiveness."

Garden parties, balls, marquees, &c., or other temporary purposes, the compressed gas is admirably adapted for, as the cylinder or other vessel can be filled at any gas works, however remote, and at either end of a journey, no service pipes from the works being required. The usual gas pendants or burners, with portable, flexible, or other tubing, being all that is necessary.

In conclusion, it ought to be remarked that Mr. Duckham's invention can be advantageously applied to lighthouses, lightships, &c.

The reading of the paper being concluded, the chairman (Admiral Selwyn) invited discussion, when Mr. Newton Wilson observed that pneumatic regulators had been, to his knowledge, in use for twenty-five years, although, he would admit, not for railway trains, and he could see no economy in the use of a regulator unless the pressure be in excess of what is required for lighting purposes. Further, he considered the hinge glass shade, which was part of Mr. Duckham's mechanism, as objectionable, since it would allow passengers to tamper with the light. For his own part he was inclined to maintain that the gas must be made continuously as it was consumed, and he believed every other plan would be found a failure in the end.

Mr. Surmon stated that he was in a position to say that gas could be made whilst the train was in motion, by the action of the locomotive, at the rate of 6 cubic feet by 1 lb. of coal; though wood could be used for the purpose, and generally 60 cubic feet could be made for one penny. The product from wood would, however, vary from this, and, without doubt, coal gas was the best for compression. From his experiments he considered it could be kept five months under pressure, and at a very trifling loss in candle power. Oil gases he found did not retain their strength so well. His experiments had been carried on for two years, and he might mention that any house could be lighted with his gas. Nothing was thrown away; and the charcoal from his gas was very good.

Mr. Darkin wished to know if Mr. Duckham used coal gas, for, if so, he would call attention to the fact that coal gas will not stand too high a pressure.

Mr. Matthews (Mr. Duckham's representative) remarked that Mr. Duckham's regulator was designed for controlling gas, whether coal or oil gas, at a *very high pressure*.

The Chairman (Admiral Selwyn) said as there appeared to be no other speakers, he would now make a few remarks on this very interesting subject, for the lighting of railway trains was an important matter of economy to the public and to the shareholders of railways, as well as a promoter of the comfort of railway travellers. However, he was not satisfied that coal gas would be the right thing for the purpose, but considered that lamps giving off gas from petroleum oil would be much more likely to meet all fair requirements. Several points had been alluded to that evening which were of more or less practical importance. The use of the hinged glass for instance, which involved the important question that the railway official would not have sole control over the light. Possibly, however, this might be got over by some new arrangement. The liability to leakage was a far more serious matter, as also the question of deterioration after storage. As to lighthouses, which Mr. Duckham had referred to as being amongst the objects to which his invention might be applied, he could state as the result of his experience, that the light must travel above you, and, therefore, he could see nothing which seemed to promise so well for lighthouse purposes as the electric light. The light of a lighthouse had, perhaps, a mile of fog to travel over or through; so that a ray of electric light overhead appeared to be the only chance of obtaining the required object without failure. The Admiral concluded by remarking that Captain Doty's burner, which he considered only a form of Silber's lamp, had satisfied the Board of Trade.

Mr. Matthews replied on behalf of Mr. Duckham by stating that practically all the objections referred to had been met and overcome. By Mr. Duckham's arrangements carriages can be connected and disconnected almost in an instant. Leakage is provided against and deterioration also; in fact, the invention appeared to be quite perfect enough for practical use.

The Chairman then proposed, and Mr. McLauchlan seconded, a vote of thanks to Mr. Duckham, for his interesting communication, which was carried unanimously; the Chairman observing that we had now arrived at a crisis in Patent Laws, for the Lord Chancellor's new Bill, if passed without extensive improvements, would work great injury to inventors and inventive progress. To meet this movement the utmost exertions of inventors and the friends of industrial progress must be put forth, and his advice was—Base your claims on the benefit of invention in advancing our industrial progress, in which he trusted that the English mechanic would lend his aid, for he was specially interested. The Council had that evening agreed that it would be desirable to call a large meeting at the Society of Arts on the subject, so that petitions against the Bill might be backed up by open public action.

Mr. Campin, who had read the paper for Mr. Duckham, briefly returned thanks on his behalf.

Mr. Mottershead proposed, and Mr. Campin seconded, a vote of thanks to Admiral Selwyn for his conduct in the chair, which being passed by acclamation, and responded to by the Admiral, the meeting terminated.

ROYAL NATIONAL LIFE-BOAT INSTITUTION.

At the last Annual General Meeting of this Institution, Earl Percy, M.P., President, the following report was read by R. Lewis, Esq., the Secretary. It commenced by stating that fifty-two years had elapsed since the Royal National Life-boat Institution was first established, with the title of the National Shipwreck Institution. Since then its usefulness had not diminished, for trade and commerce had vastly increased, and the number of those who "go down to the sea in ships, and do their business in the great waters," had multiplied a hundredfold. Yet the risks of navigation had not grown less; the gales blew as of old; the dangers of our coast, with its rapid and varying tides, its treacherous outlying sandbanks, and sunken reefs, remained the same; and, as a consequence, the number of fatal wrecks was even greater than before. There was accordingly no probability that the demand for the Society's help would be less in the time to come than it had been in the past, or that a less noble field for philanthropic and Christian work would present itself. Since the last Annual Report eighteen new Life-boats had been placed on the coast. During the past year the Institution's Life-boats, which are 254 in number, had saved *seven hundred and twenty-seven* persons, nearly the whole of them under perilous circumstances, when ordinary boats could not have been employed without extreme risk to those on board of them. The services of the Life-boats on every occasion were, as usual, of the most determined character, and in nearly every instance were attended with complete success. During the past year 12 silver medals, 18 votes of thanks inscribed on vellum, and £3,289 had been granted by the Society for saving 727 lives by Life-boats, and 195 lives by Fishing-boats and other means. The number of lives saved from its first establishment to the present time, either by its Life-boats or by special exertions for which it had granted rewards was 22,790. Since the formation of the Institution it had voted 91 gold and 870 silver medals for saving life, besides pecuniary rewards to the amount of £47,200. The Committee cordially acknowledged the continued co-operation of the Lords Commissioners of the Admiralty, the Admiral Superintendent of Naval Reserves, the officers and men of the Coastguard Service, the Local Branch Committees and their Honorary Secretaries, and the coast boatmen and fishermen. The efforts of the Board of Trade in the maintenance and extension of the Rocket Apparatus on the Coasts of the United Kingdom were unceasing. Many very liberal Donations and Legacies received during the past year were gratefully acknowledged. The total amount of the receipts in that period had been £39,835 15s. 4d., and of that sum £12,932 9s. 6d. was the result of special gifts to defray the cost of thirteen Life-boats. The expenditure, including liabilities, had amounted to £39,495 7s. 5d. The items of receipt and expenditure were detailed in the financial statement annexed to the Report, audited as usual by Mr. Lovelock, public accountant. The Committee thankfully acknowledged the support and encouragement that had hitherto been afforded them, but they were deeply sensible that much remained to be done, and which could only be done successfully by the continued liberal support of the public. In conclusion, they added that the 23,790 men thus saved, some of whom, instead of being to-day valuable members of our busy commercial community, in the absence of the services of Life-boats, would almost to a certainty have been engulfed by the raging tempests, leaving, in too many cases, widows and orphans to mourn their loss—pleaded on behalf of the National Life-boat Institution in far more eloquent terms than any human language could express or testify.

The adoption of the Report was moved by George Lyall, Esq., and seconded by the Admiral of the Fleet, Sir George Sartorius, K.C.B.

Sir George Sartorius, in speaking to the resolution, said that in bygone days in the exciting time of war they found no difficulty in obtaining volunteers for any work however difficult the only difficulty was to choose from amongst those who offered. The same feeling he was happy to say still existed and was as strong as ever. (Cheers.) It was the fashion to say that our seamen were degenerating, but the report showed that was not the case. Everything done had been done by volunteers, for the brave Life-boat crews were all volunteers. The perils of night, of wind and cold, the launching of the boat, were difficulties of which those living at home at ease had but slight notion; few knew the pluck required for such work. These he contended were proofs that our sailors were quite as courageous and gallant now as they were in the days of his youth seventy years ago. (Cheers.)

After some other proceedings the meeting closed with a vote of thanks to the chairman.

STEWART'S PATENT FLAG SIGNAL FOR RAILWAY CARRIAGES.

Recently a working model of an improved communication between the passengers, guards, and drivers of railway trains, was exhibited at the Royal Institution, Albemarle-street, by Mr. Charles Stewart, M.A., the inventor and patentee. The apparatus employed is enclosed in a small wooden box and placed inside the carriage against one of the top corners of the compartment. On a catch being released, by the means of a cord which passes through each of the compartments of the carriage near the roof, a roller containing a red flag is projected through the side of the carriage, just beneath the eave of the roof, which flag unrolls itself by the action of gravity, and at the same time a rope in connection with the apparatus, running from end to end of the train, causes a bell to be rung in the guard's van, and the whistle of the engine to be sounded, whereby the attention of both the guard and the engine-driver is called to the carriage from which the flag is displayed. The signal is equally available at night-time, as the bright light from the interior of the carriage being reflected upon or seen through the red flag, renders the latter visible. After an alarm has been given, the flag can be readily wound up again on its roller and returned to its original position by the guard or other person from the outside of the carriage, but cannot be reset by anyone from within the carriage. This invention may certainly claim consideration, not only on the score of simplicity, but also on economical grounds, as it can be applied with the greatest facility to the existing rolling stock, and the cost of the apparatus need not exceed a two-hundredth part of the cost of the carriages themselves. Mr. Stewart's model was inspected with much interest by the distinguished persons present on the occasion, many of whom expressed their entire approval of his invention.

THE INVENTORS' INSTITUTE,

4, ST. MARTIN'S PLACE, TRAFALGAR SQUARE, LONDON.
ESTABLISHED 1ST MAY, 1862.

Past Presidents :

SIR DAVID BREWSTER, K.H., LL.D., F.R.S., &c., from the establishment of the INVENTORS' INSTITUTE, till his decease, February, 1868. LORD RICHARD GROSVENOR, M.P.

President of Council, SIR ANTONIO BRADY.

SESSION 1875-76.

Attendance of Members and their friends is requested on—

THURSDAY, May 11th.—Patent Law Conference (if progress of the Patents for Inventions Bill render same desirable), and Mr. Bevan's Postponed Paper (if time permit).

THURSDAY, May 25th.—Annual General Meeting, at 4 o'clock p.m.

TO MEMBERS OF COUNCIL.

Council meeting to take place at half-past 3 p.m. on Annual Meeting Day.

LIST OF PROPOSED MEMBERS OF EXECUTIVE COUNCIL.

President, Sir A. Brady.
Vice-Presidents, as per List advertised on Last Page.
Secretary, F. W. Campin.

And Messrs. H. Bessemer, C.E.; C. W. Siemens, C.E., F.R.S., &c.; Dr. J. McGregor Croft; F. Ransome, C.E.; D. J. McLauchlan; F. H. Varley, C.E.; T. Morgan; A. J. Murray; S. Calley; H. C. Allardyce;* T. Paterson;* A. Sweet.*

N.B.—The * denotes new names.

Several additions to the General Council (see advertised list) are expected to be proposed; country members wishing to propose any other names, if not able to attend the Annual General Meeting, should communicate with the Secretary.

Subscriptions are payable to Mr. G. A. STRETTON, the Receiver, 4, St. Martin's-place, S.W., who is the proper official to give receipts.

F. W. CAMPIN, Sec.

Proceedings of the Institute.

IN consequence of what passed at the Executive Council of the Institute on 23rd March, a Public Conference on the subject of the Patents for Inventions Bill, 1876, convened by Sir Antonio Brady, President of the Council of the Institute, and Mr. F. W. Campin, the Secretary, was held at the Hall of the Society of Arts, on Tuesday, 25th April. The proceedings were opened by a very lucid address by Sir A. Brady, the Chairman, when Admiral Selwyn moved and Mr. Parker Rhodes seconded the first resolution, which was as follows:—

"That the truest and highest public policy requires that inventors and their inventions should receive the protection and encouragement of the State." This resolution was carried unanimously.

The second resolution was then moved by Mr. W. Smith, C.E., and seconded by Mr. F. H. Varley, C.E. It was as follows:—"That this protection should be placed on the same basis as the protection given by law to all other property, acquired or created." This was passed unanimously.

A third resolution was moved by Mr. A. J. Mundella, M.P., seconded by Mr. M. Prior, Secretary of the Sheffield Trades Council, and supported by Dr. R. H. Collyer, and carried unanimously. It was to this effect:—"That the encouragement should be, first, by correct registration of all inventions in the Patent Office; secondly, by free access for inventors to the examining staff and their records; thirdly, by a lowering of the cost of protection, so as to bring such protection within the reach of every working man."

Mr. Thomas Paterson then moved, and Mr. S. Calley seconded, the fourth resolution:—"That the only method by which an inventor ought to be rewarded, is from the pecuniary results of his invention for a limited period, and not by State rewards." This was carried unanimously.

Mr. F. W. Campin moved, Mr. J. M. Hyde seconded, and Mr. Mottershead supported, the fifth resolution:—"That the Bill on the Patent Laws now before the House of Commons, fails in many points to recognize the important bases set forth in the foregoing resolutions, and therefore requires modifications in accordance with such resolutions; and it is hereby referred to a committee to settle the same, and take action accordingly; said committee to consist of same persons who attended the conference at Sir A. Brady's in March last, and such persons attending the present conference as may desire to serve thereon." This, also, was passed unanimously.

The conference was attended by many representatives from trade organizations, working men's institutions, chambers of commerce, &c.

At the Members' Meeting on 27th April, F. H. Varley, Esq., C.E., Vice-President of Council, in the chair, Mr. Bevan's paper, which had been appointed to be read, being postponed at his request, Mr. HENLEY read a short paper on his "Improved Unshipping Rudder;" but we are compelled to defer our report for the present.

Monthly Notices.

Deaths of three Anthropologists are announced, viz., Dr. Richard King, founder, in 1844, of the Ethnological Society of London, and a distinguished Arctic explorer. Dr. G. D. Gibb, of Westminster Hospital, since known as Sir Duncan Gibb, Bart., who was one of the founders, in 1863, of the Anthropological Society of London, contributing to its proceedings many curious observations on the human epiglottis, the *arcus senilis* in the eyes of elderly people, and other matters of interest. Mr. T. J. Biddle Lloyd, a civil engineer and geologist of distinction, was author of some useful papers on the inhabitants and prehistoric remains of Newfoundland.

An International Congress of Orientalists at St. Petersburg is to take place. Persons desirous of becoming members can obtain cards of membership by applying in writing to Mr. Robert K. Douglas, Corresponding Member of the Russian Committee of Organization, at the Royal Asiatic Society, 22, Albemarle-street, Piccadilly, W., and in all cases the amount of subscription (10s.) should accompany the application.

Mr. Tennyson's "Queen Mary" has received at the hands of the poet various changes for performance as a play. The drama has been shortened throughout, and has gained sharpness and clearness by being shortened. The chief additions are two in number. The first is a conversation between Philip and Mary about Howard and about striking the flag of England. The lines on this subject are likely to tell with the audience. The other alteration is at the close. Mary does not expire before the entrance of Elizabeth, but dies in the presence of her sister, after a touching scene. The new matter inserted here is longer than that introduced in the other place.

"Elsa and her Vulture," of "Geier-Wally," Madame von Hillern's "German Peasant Romance," is to be introduced to the English stage in a dramatized version, which will be based, with Messrs. Longman's permission, on Lady Wallace's translation, lately published.

Mr. Crookes's "Radiometer" can, as a "Photometer," be conveniently and accurately used as has been shown in his paper read before the Royal Society on the 10th of February, and the process of determining by it the quantity of light emitted from a gas flame, or any other source of light, is most fully described.

Mr. W. C. Reid on Mineral Phosphates.—The *Journal* of the Newcastle-on-Tyne Chemical Society contains a valuable paper, in which analyses are given of all the more important coprolites and phosphatic nodules used in the manufacture of artificial manures.

Mr. Bennet Woodcroft has resigned his position at the Patent Office, and has been succeeded by Mr. Reder Lack.

A Scientific College for Distillers and Brewers in Berlin, for the especial cultivation of the sciences which bear upon fermentation and distillation, is about to be established by the great German distillers.

Flying machines and Pénaud's artificial bird, for the invention of which the Academy of Sciences awarded M. Pénaud a prize in June last, is the subject of a paper by Prof. Alfred M. Mayer of the Stevens Institute in the *Journal* of the Franklin's Institute. He describes some "helicopterons," or aërial screw-propellers, which have been successful in raising themselves in flight.

A New Mineral from Etna is analyzed in the *Gazzetta Chemica Italiana,* which recently contained a paper by O. Silvestri, giving a new interpretation of some volcanic phenomena, and an analysis of a new mineral from Etna. On the cessation of the eruption of Etna in August, 1874, a peculiar substance was observed on the surface of the recent volcanic lava, of a peculiar metallic silvery lustre. A few scales were detached and examined; they were found to be a compound of nitrogen and iron, having the composition $Fe_5 N_2$. This shows the mineral to be analogous to the artificial product obtained, by M. Frémy, by heating chloride of iron, to dull redness, in a current of dry ammonia. A series of experiments made by the author on Dissociation proved that the gases escaping from the volcano effected the decomposition of the lava, and the formation of the mineral examined.

The Council of the Royal Society have made their selection of the fifteen candidates to be recommended to the Society for election. The names are: Capt. Abney, R.E., Prof. H. E. Armstrong, Ph.D., Rev. W. B. Clarke, M.A. (New South Wales), J. Croll (Geol. Surv. Scot.), E. Dunkin, Sec. R.A.S., Prof. J. E. Erichsen, Dr. Ferrier, Col. Lane Fox, Prof. A. H. Garrod, R. B. Hayward, M.A. (of Harrow), C. Meldrum, M.A. (Mauritius), E. J. Reed, C.B., Prof. W. Rutherford, R. Swinhoe, and Prof. T. Thorpe.

Proceedings of Societies.

ROYAL SOCIETY.

March 16th.—Dr. Hooker, C.B., President, in the chair.—The following papers were read: "Preliminary Reports to Dr. Wyville Thomson of the Scientific Work done on Board the Challenger,"—"On true Corals," by Mr. H. N. Moseley.—"On Oceanic Deposits and Surface Organisms," by Mr. J. Murray,—"On Crustacea," by Mr. R. von Willernöes-Suhm,—and "On Chemical and Geological Observations," by Mr. J. Y. Buchanan, published by permission of the Lords of the Admiralty.

March 23rd.—Dr. Hooker, C.B., President, in the chair.—The following papers were read: "On the Forces caused by the Communication of Heat between a Surface and a Gas, and on a new Photometer," by Prof. O. Reynolds,—"On the Nature of the Force producing the Motion of a Body exposed to Rays of Light and Heat," by Mr. A. Schuster,—"Description of a Mammalian Ovum in an early Condition of Development," by Mr. E. A. Schäfer,—"On the Number of Figures in the Period of each Reciprocal of a Prime from 53·000 to 60·000," by Mr. W. Shanks,—"On a new Refractometer for Measuring the mean Refraction Index of Plates of Glass and Lenses by the Employment of Newton's Rings," by Dr. Royston-Pigott,—and "Preliminary Report to the Hydrographer of the Admiralty on Some of the Results of the Cruise of the Challenger between Hawaii and Valparaiso," by Prof. Wyville Thomson.

March 30th.—Dr. Hooker, President, in the chair.—The following papers were read: "On an Experiment in Electro-Magnetic Rotation," by Mr. W. Spottiswoode,—"On the Residual Charge of the Leyden Jar," by Mr. J. Hopkinson,—"On the Placentation of Lemurs," by Prof. Turner,—and "On the Movement of the Glass Case of a Radiometer with inclined Vanes," by Mr. W. Crookes.

April 6th.—Dr. Hooker, President, in the chair.—The following papers were read: "Experiments on the Friction between Water and Air," by Dr. Ritter von Lang,—"An Inquiry into the Cause of the Slow Pulse in Jaundice," by Dr. W. Legg,—"On the Structure of a Species of Millepora occurring at Tahiti," by Mr. H. N. Moseley,—and "Supplemental Note to a Paper on the Structure, Physiology, and Development of *Antedon rosaceus* (Comatula, Lamk.)," by Dr. Carpenter.

ROYAL INSTITUTION.

April 3rd.—G. Brock, Esq., V.P., in the chair.—Mrs. W. A. T. Amhurst, The Lady A. Leveson Gower, Miss W. L. Hall, Miss M. H. M'Clean, Lieut.-Col. C. Buckle, Dr. M. Garcia, Prof. A. J. Bernays; Messrs. F. J. Bramwell, H. S. Snell, S. Sanders, W. W. Turton, G. W. Walter, A. V. White, and J. W. Remington-Wilson, were elected Members.

ZOOLOGICAL SOCIETY.

March 21st.—Dr. F. Hamilton, V.P., in the chair.—Mr. Sclater exhibited and made remarks on a series of skins of the parrots of the Fiji Islands, obtained by Mr. E. L. Layard, F.Z.S., and called special attention to a new species of the genus Pyrrhulopsis of Reichenbach from the Island of Taviuni, which Mr. Layard had proposed to call *P. Taviunensis*. Papers and communications were read: by Mr. A. G. Butler, containing descriptions of some new Lepidoptera from the collection of Lieut. H. Roberts,—from Mr. A. Anderson, containing corrections of and additions to a former paper of his on the Raptorial Birds of North-Western India,—by Mr. H. Saunders, on the Stercorariinæ or Skua Gulls, in which he revised and corrected the synonymy of several species, and traced their respective ranges so far as they were known. He considered that *Stercorarius Chilensis* (Bp.), although more nearly allied to the Northern form *S. catarrhactes* than to *S. Antaccticus*, was perfectly distinguishable from either by its constant rufous colouration of the under parts and axillaries; its range as at present known being restricted to the west coast of South America. The range of *S. pomatorhinus* was shown to extend from S. lat. 82° N. to about 30° S., and that of Richardson's Skua, to which he restored the original, but lately disused name of *Stercorarius crepidatus*, reached from 82° N. to more than 40° S., on the coast of New Zealand: *S. spinicauda* (Hardy), from the African coast, being regarded as merely this bird in winter dress.

April 4th.—Prof. Newton, V.P., in the chair.—The secretary read a report on the additions made to the menagerie during March. He called particular attention to a male brown monkey (*Macacus brunneus*, Anderson), from Siam; two caracaras (*Polyborus tharus*), in a very remarkable plumage, said to have been obtained in Patagonia; a lead-coloured falcon (*Hypotriorchis concolor*), captured on board a vessel on its passage down the Mozambique Channel; and three sirens (*Siren lacertina*, Linn.), from South Carolina. Mr. H. E. Dresser exhibited and remarked on a hybrid between the black grouse and hazel grouse, supposed to have been obtained in Norway. Prof. Newton exhibited and remarked upon a copy of a Dutch translation of Pliny, containing a figure of the dodo (*Didus ineptus*), and belonging to the Rev. R. Hooper, which seemed to be an earlier edition of the same work which was formerly in the possession of the late Mr. Broderip, and was described by him in the Society's *Transactions* (vol. iv., p. 183). Mr. R. B. Sharpe exhibited a true Swedish *Surnia ulula*, obtained many years ago at Amesbury, in Wiltshire, being the first recorded British-killed example of this species. Papers were read by Mr. A. H. Garrod, on the organs and some of the most important muscles of the darter (*Plotus anhinga*), described from specimens recently living in the Society's collection,—by Mr. E. R. Alston on the genus dasyprocta, describing a new species, from Central America, for which the name *Dasyprocta isthmica* was proposed: the geographical range and synonomy of the other agoutis were reviewed; *D. punctata* of Central America was regarded as distinct from *D. azaræ* of S. Brazil, and *D. variegata* was shown to extend into New Grenada: in all ten species of agouti were recognized as distinct,—by Mr. P. L. Sclater and Mr. O. Salvin, on fifteen new species of birds from Bolivia: amongst these was a singular new form belonging to the Tanagridæ, proposed to be called *Malacothraupis dentata*,—by the same authors, containing a revised list of the Neotropical Anatidæ.

PHYSICAL SOCIETY.

March 25th.—Prof. G. C. Foster, President, in the chair.—The following candidates were elected Members: Prof. Liversidge, the Marquis of Salisbury, Messrs. W. Ackroyd, T. Preston, and W. Merritt. Mr. O. G. Lodge made a communication "On the Flow of Electricity in a Plate," in continuation of a paper which he read before the Society February 26th. In order to apply the principle of images already described to the flow of electricity in plates bounded by straight lines, it is necessary that the angles of the plate should be aliquot parts of 180°; and, since this condition excludes obtuse angles, the number of rectilinear figures which can be treated is limited. They are rectangles, equilateral triangles, two cases of right-angled triangles, the two limiting cases of isosceles triangle, for which the equal angles are 0° and 90° respectively, and many cases of the general two-sided polygon or "wedge," including the regular two-sided polygon or "strip." Since the images of a pole in a wedge lie on a circle, as in a kaleidoscope, Cote's property of the circle may be applied to obtain expressions for the potential of any point, and for the electrical resistance of the plate to the flow from any number of point poles situated anywhere in it. The expressions are rather long, but they become simpler in certain special cases which were pointed out. Making the angle of the wedge vanish, the expressions modify into corresponding expressions for the strip, the resistance expressions of which always contain hyperbolic trigonometrical functions of the positions of the poles. The potential function for a circular sector also follow from the general case of the wedge. The general resistance formula, applied to the case of the isosceles right-angled triangle, leads to some continued products, all of which are generalizations of Wallis's expressions for $\frac{\pi}{2}$ The product of these products, which is itself of the same form, has been reduced by Mr. J. W. L. Glaisher to the complete elliptic integral usually denoted by K, its modulus being S in 45°. This quantity appears in all the resistance expressions for right-angled triangles and squares which the author has yet examined. The case of an equilateral triangle leads to more complex and interesting products, which were reduced by Mr. Glaisher to the product of two theta functions with S in 75° as a modulus. When the conditions of flow are known in one rectilinear figure, they may be extended to a large number of others by alternate processes of reflecting the plate in one of its own boundaries, and of cutting it along one of its straight flow or equipotential lines. Diagrams of such transition figures were shown. In order to obtain resistance of a compound conductor by means of the known resistance of its components, it is necessary that the flow conditions in each component shall remain entirely unaffected by their being connected together. Thus, if the resistance of a circuit consisting of two wires side by side is to be deduced from the resistance of the wires separately, by the ordinary method of adding their conductivities, it is necessary either that the wires shall not touch each other, or that, if they do, no flow shall pass across the junction. This rule is often overlooked, and the oversight has given rise, in certain cases, to a notion of electrical "interference." The concluding part of the paper has to do with the flow conditions when line poles are combined with point poles in a sheet, especially when point electrodes are introduced into a sheet in which a uniform current or "river" is flowing across the sheet. Dr. Guthrie communicated a fourth paper "On Salt Solutions and attached Water." It consists mainly of the behaviour of a salt solution when cooled below the freezing point of water.

CHEMICAL SOCIETY.

March 16th.—Prof. Abel, President, in the chair.—Dr. J. H. Gladstone proposed a vote of thanks to the President, for the exceedingly enjoyable visit to the Royal Arsenal at Woolwich, on the previous Tuesday, and for his generous hospitality on that occasion. This was seconded by Dr. Gilbert, and carried by acclamation. The papers read were, "On Crystallized Glycerin," by Dr. P. F. van H. Roos,—"Notes on the Fatty Acids, and on a Suggested Application of Photography," by Mr. W. H. Hatcher,—"On Stibine," by Mr. F. Jones,—"On the Use of Platinum in the Ultimate Analysis of Carbon Compounds," by Mr. F. Kopfer,—and "On the Action of Organic Acids and their Anhydrides on the Natural Alkaloids,,' Part V., by Mr. G. H. Beckett and Dr. C. R. A. Wright.

April 6th.—Prof. Abel, President, in the chair. The first paper read was a "Preliminary Notice on the Action of Sulphuric Acid on Naphthalene," by Dr. J. Stenhouse and Mr. C. E. Groves From amongst the products of the reaction, the authors have succeeded in isolating two new isomeric compounds, which they call naphthalene sulphones. Three notes from the laboratory of the Yorkshire College of Science were communicated by Prof. T. E. Thorpe, namely, "On the Action of the Copper Zinc Couple on Potassium Chlorate and Perchlorate," by Mr. H. Eccles: "On Thallium Chlorate," by Mr. J. M. Aird; and "On the Isometric Relations of Thallium," by Mr. Thorpe. Dr. H. E. Armstrong read a paper "On the Nomenclature of the Carbon Compounds."

METEOROLOGICAL SOCIETY.

March 15th.—Mr. H. S. Eaton, President, in the chair.—Major F. B. Gritton, Lieut.-Col. G. E. Bulger, Rev. E. W. Watts, Messrs. R. T. H. Bartley, J. W. Budd, W. B. Clegram, J. S. Dyason, J. Eunson, T. W. Grindle, J. Hardwicke, and A. O. Walker were elected Fellows. The following papers were read: "On the Rhé-Electromètre of Marianoni," by Mr. R. J. Mann,—"On the Variation of Errors in Hydrometers," by Mr. R. Strachan,—"On the Deduction of Mean Results from Meteorological Observations," by Mr. L. F. Kämtz, translated from the *Repertorium fur Meteorologie*, by Mr. J. S. Harding,—"Summary of Observations made at Stanley, Falkland Islands, during 1875," by Mr. F. E. Cobb, —and "Contributions to the Meteorology of West Australia," by Mr. R. H. Scott.

GEOGRAPHICAL SOCIETY.

March 27th.—Major-General Sir H. C. Rawlinson, President, in the chair. The following gentlemen were elected Fellows: Commander Y. O'Keefe, Capt. G. S. C. Stevenson, Rev. G. E. Cotterill, Rev. J. Gaskin, Messrs. A. P. Agar, R. Anderson, N. Boyd, A. D. Carlisle, G. N. Conlan, W. E. Hall, E. H. Hancock, T. W. Masterman, and W. L. Watson. The paper read was, "On the North American Boundary from the Lake of the Woods to the Rocky Mountains," by Capt. S. Anderson.

April 11th.—H.R.H. the Duke of Edinburgh, Honorary President, in the chair.—The following gentlemen were elected Fellows:—Capt. B. C. Norman, Capt. R. R. Patterson, Capt. W. F. Segrave; Messrs. A. Gould, R. R. Hazard, T. Livingstone-Learmonth, and R. H. C. Pallett. The paper read was "Journey across Africa from Bagamoyo to Buenguela," by Lieut. V. L. Cameron, R.N.

SOCIETY OF ARTS.

March 17th.—Prof. Williamson in the chair.—The paper read was "On the Preparation of Dextrine-Maltose (malt-sugar), and its Use for Brewing and other Purposes," by Mr. W. Valentin. The new sugar can be obtained from rice, potatoes, or any other starch-producing plants. Its use as a substitute for, or in conjunction with, malt in brewing was the chief feature of the paper.

March 22nd.—W. Galt, Esq., in the chair. —The paper read was "On Improvements in Railway Couplings, as a Necessity of the Day," by Mr. T. A. Brocklebank.

March 24th.—Sir G. Campbell in the chair.—The paper read was "On the Land Revenues of India," by Major-General Marriott.

March 28th.—Lieut.-Gen. Bissett in the chair.—The paper read was "On the Industries of South Africa," by Mr. T. B. Glanville.

March 29th.—Lord A. Churchill in the chair.—The paper read was "On Model Dwellings for the Rich," by Messrs. T. R. Smith and W. H. White. The paper advocated a scheme of building houses in flats, and gave in some detail the necessary arrangements for this purpose.

March 31st.—Prof. Odling in the chair.—The paper read was "On some Methods of Estimating the Illuminating Power and Purity of Coal-Gas," by Mr. A. V. Harcourt. Mr. Harcourt began by drawing attention to his new sulphur test. The gas is heated to decompose the sulphur compounds, and the sulphuretted hydrogen thus produced colours a lead solution through which the heated gas is passed. By comparison with a standard solution, the amount of sulphur in the gas is estimated. He then alluded to the possible employment, as photometers, of Mr. Crooke's radiometer, and Dr. Siemens' apparatus for showing the electric conductivity of selenium when exposed to light. Lastly, he described a standard gas—hydrogen carburetted by passage through petroleum, which he proposed to employ instead of the ordinary sperm candles.

April 5th.—Vice-Admiral E. Ommanney in the chair.—The paper read was "On the Cultivation in India of Caoutchouc-yielding Trees," by Clements R. Markham.

April 19th.—Dr. Billing in the chair.—The paper read was "On the so-called Deposits of Onyx near Mexico," by Mr. W. Eassie. The material closely resembles the Algerian onyx-marble. It is not a true marble, but probably a stalagmitic deposit, chiefly of carbonate of lime, but containing also a large quantity of carbonate of protoxide of iron, some carbonates of magnesia, manganese, &c. Its applications for artistic and decorative purposes were dwelt on at some length.

GEOLOGICAL SOCIETY.

March 22nd.—Prof. P. M. Duncan, President, in the chair.—Lord Rosehill, Messrs. F. Campion, H. J. Gardiner, H. P. Holt, H. Underhill, F. T. Whitehead, and T. Wrightson, were elected Fellows. The following papers were read:—"On the Triassic Strata which are exposed in the Cliff Sections near Sidmouth, and a Note on the Occurrence of an Ossiferous Zone containing Bones of a Labyrinthodon," by Mr. H. J. J. Lavis,—"On the Posterior Portion of a Lower Jaw of Labyrinthodon (*L. Lavisi*), from the Trias of Sidmouth," by Mr. H. G. Seeley,—"On the Discovery of Melonites in Britain," by Mr. W. Keeping, —and "Note on the Phosphates of the Laurentian and Cambrian Rocks of Canada," by Principal Dawson.

April 5th.—Prof. P. M. Duncan, President, in the chair.—Mr. Mansergh was elected a Fellow. The following communications were read: "The Bone-Caves of Cresswell Crags," Second Paper, by the Rev. J. Magens Mello,—"On the Mammalia and Traces of Man found in the Robin Hood Cave," by Mr. W. B. Dawkins,—"Notes on the Gravels, Sands, and other Superficial Deposits in the Neighbourhood of Newton-Abbot," by Mr. H. B. Woodward,—and "On certain Alluvial Deposits associated with the Plymouth Limestone," by Mr. R. N. Worth.

LINNEAN SOCIETY.

March 16th.—Prof. Allman, President, in the chair.—Dr. J. Anderson communicated a note "On the Plastron of the Gangetic Mud-Turtle," wherein an embryo from the egg had eleven, and not the usual nine, bones in the region in question. Mr. A. W. Bennett read a paper "On the Rate of Growth of the Flower Stalk of the Hyacinth," in which he showed that the greatest energy of growth is in the lowermost part of the stalk. This agrees with the recorded observations respecting the relative growth of different nodes of a stem, where the greatest energy is always at a considerable distance from the apex. But it offers a contrast to the phenomena exhibited in the submerged flower-stalk of Vallisneria, where the greatest energy of growth is in the terminal portion beneath the flower-bud. Mr. F. Darwin read an interesting account of his observations "On the Hygroscopic Mechanism by which certain Seeds are enabled to Bury themselves in the Ground." The Rev. J. M. Crombie's paper "On the Lichens of Antarctic America, collected by Dr. R. O. Cunningham during the Voyage of H.M.S. Nassau, 1867-9," was briefly referred to by the Secretary. It contains a record of ninety-seven species and varieties, whereof thirteen of the former, and eleven of the latter, besides one genus, Endocena, are used. The rest of the evening was occupied in the "Discussion on the Potato Fungus." Mr. Carruthers supported the views of Prof. De Bary, which were opposed by the Rev. M. Berkeley, Mr. W. Smith, and Mr. A. Murray. Mr. Renny was inclined to think there were discrepancies, possibly, on both sides, and Mr. Thiselton Dyer noted that at least Artoliagus yet needed a separate investigation.

April 6th.—G. Busk, Esq., V.P., in the chair.—A kingfisher, which was drowned by the closing of the valves of a Unio, was exhibited by Dr. Day. Some rare mosses, obtained in Kent, were shown and remarked on by Mr. E. M. Holmes. He also exhibited and adverted to a specimen of the root and foliage of *Thapsia garganica*, var. *silphium*, deadly to horses and camels, though highly curative as a topical agent for wounds in man. Mr. G. I. Romanes read "An Account of some New Species, Varieties and Monstrous Forms of Medusæ." These were obtained last summer in the Cromarty Firth. Regular and irregular multiplication of parts were observed, their increase being in the proportion of one-third of the normal number: diminution of parts is less frequent. A parasitic crustacean lives at the expense of the bodies of aurelia.—Dr. F. Day read a paper "On some of the Fishes of the Deccan." He strongly recommends the "Masheer" *Barbus tor* to English pisiculturists as worthy of introduction into our rivers. This fish is well known, not only for the sport it affords the angler, but for the excellence of the flavour of its flesh. It equals or even surpasses the salmon in size, but, unlike the latter, never enters salt water. It deposits its ova in the hill streams. For these and other reasons he believes it well adapted for acclimatization. A second paper of Dr. Day's referred to the "Introduction of Trout and Tench into India." He states the Loch Leven trout (*Salmo Levensis*) and the tench (*Tinca vulgaris*) have bred there. A specimen of the former, reared in the Neilgherry waters, was exhibited at the meeting. This weighed $1\frac{1}{4}$ oz. out of spirit, and had an extreme length of $6\frac{1}{2}$ inches. Mr. Thomas, of the Madras Civil Service in 1863, and Dr. Day in 1866, each attempted, but with unsuccessful results, to carry out and hatch trout ova in India. Mr. M'Ivor was more fortunate, for in 1873 he wrote, "all our fish are breeding rapidly," &c. The above specimen laid before the society was caught in January, 1876. Mr. C. H. Wade read some "Notes on the Venous System of Birds," relating to irregularities in distribution, &c. Dr. J. D. M'Donald contributed a paper "On Trematodes and Leeches," showing certain analogies between these groups. "Critical References on Webb's Type-Shells of the Canaries," by the Rev. R. B. Watson, and a "List of Shells from the Solomon Islands," by Mr. E. A. Smith, were two somewhat technical papers briefly summarized and noticed by the secretary.

INSTITUTION OF CIVIL ENGINEERS.

March 21st.—Mr. G. R. Stephenson, President, in the chair.—The paper read was descriptive of ' The Hydraulic Canal Lift at Anderton, on the River Weaver," by Mr. S. Duer.

March 28th.—Mr. G. R. Stephenson, President, in the chair. The papers read were "On Sewage Interception Systems, or Dry-Sewage Processes," by G. R. Redgrave; and "On the Treatment of Sewage by Precipitation," by Mr. W. Shelford.

April 4th.—Mr. G. R. Stephenson, President, in the chair.—The Council have recently transferred Messrs. R. A. Heenan, L. R. Roberts, and C. Thwaites from the class of Associates to that of Members, and have admitted the following candidates as Students of the Institution: Messrs. R. W. Baynes, W. A. Benson, R. C. Brebner, C. J. Grierson, E. Quick, H. J. Saunders, C. H. Shortt, J. R. Tickell, C. F. Tufnell, and W. C. Tyndale. Mr. J. Ramsey was elected a Member, and Messrs. C. S. Allott, R. de Arteaga, H. S. Barron, C. J. Boustead, T. W. Davies, A. Davidson, D. Earnshaw, N. Garrard, C. C. Gregory, F. A. Heath, T. Jeffries, J. Mackenzie, J. O'Connell, B. L. F. Potts, O. Turner, R. E. Wilson, T. P. Wilson, and Col. J. D. Shakespear, Associates.

SOCIETY OF ENGINEERS.

April 3rd.—Mr. V. Pendred, President, in the chair.—A paper, by Mr. J. Steel, "On Air Compression," was read.

BRITISH ARCHÆOLOGICAL ASSOCIATION.

March 23rd.—H. S. Cuming, Esq., V.P., in the chair.—Mr. Blashill exhibited some curious Roman remains, from the village of Putley, in Herefordshire, found in the foundation of the north wall of the parish church, and probably from a Roman building formerly on the site. Mr. Cuming described two anelaces found in London, and transmitted for exhibition by Mrs. Bailey. Mr. Birch read a letter from Miss Bernard, enclosing a rubbing of a very finely floriated sepulchral slab lately discovered in the church of Ross, Herefordshire. Mr. Irvine forwarded a copy of the oath taken by the Mayors of the city of Rochester, from a volume in the possession of the Corporation. Mr. Irvine also sent casts, in gutta-percha, of the city seal, obtained by permission of L. Levy, Esq., late Mayor; and drawings of heraldic shields found slightly incised on the wall of the south transept of the cathedral at Rochester. Mr. Cuming described an antique carved bone scratchback, exhibited by the Rev. S. M. Mayhew, and a variety of domestic objects found in the Inner Temple, and a knife from St. Mildred's church. Mr. L. Brock exhibited some fine coloured Dutch tiles, from Malines and London. Mr. Blashill read a most elaborate paper by the Rev. Precentor Walcott "On Ground Plans, Regular and Secular." Mr. Cuming read a paper "On Bouquetières." Mr. Morgan made some remarks on the oak carving exhibited at the previous meeting.

ASTRONOMICAL SOCIETY.

April 12th.—W. Huggins, Esq., President, in the chair.—Sir D. Solomons, Messrs. J. B. Smith, W. T. Smedley, W. Durrad, W. Allsup, and the Rev. J. Furguson, were elected Fellows. Mr. Penrose described an instrument for calculating the sides and angles of spherical triangles. It consisted of two wooden semicircles, which could be fixed at any angle, and a graduated arm, moving on a universal joint, which slid along one of the semicircular arcs. The graduated arm was made use of to measure the cord of the third side of the triangle. Mr. Penrose showed how the instrument might be made use of for roughly checking calculations in spherical trigonometry. He thought that it would also be of use in expeditiously reducing observations in which no degree of accuracy was required. The instrument was very portable, and might be made still more so if the graduated semicircles were divided on brass instead of on wood, as in the instrument he showed. A paper, by the Rev. T. W. Webb, was read, describing some observations of the two exterior satellites of Uranus, which had been made by Mr. I. Ward, of Belfast. Mr. Ward's instrument is a refractor of only 4·3 inches aperture; but he had apparently succeeded, on some dozen evenings during the months of January, February, and March, in picking up both the outer satellites, Titania and Oberon. A table was given comparing the position, angles, and distances as estimated by Mr. Ward with those taken from Mr. Marth's ephemeris of the satellites. It was stated that the estimates of Mr. Ward had been made without any previous reference to the ephemeris; the coincidences were such that there seemed little room left for doubt that Mr. Ward had, in each instance, been successful in picking up the satellites. Mr. Lassell said, that he had not seen the satellites with his own 9-inch. It was quite possible that the extraordinary sharpness of Mr. Ward's eye might have enabled him to pick up the satellites of Jupiter with the naked eye. He thought that if any one else made use of the same telescope they would certainly not be able to detect the satellites. Mr. Green drew the attention of observers to the visibility of the dark limb of Venus during the coming quadrature; he had on many occasions thought that he perceived the dark limb on a brighter background, but on placing the bright limb of the planet behind a dark bar in his eye-piece, he had entirely lost sight of the dark limb. He wished that other observers would try the same experiment during the coming quadrature.

MICROSCOPICAL SOCIETY.

April 5th.—H. C. Sorby, Esq., President, in the chair.—Messrs. C. S. Bentley and P. J. Butler were elected Fellows. A paper, by M. Rénard, of Louvain, "On Some Results from a Microscopical Study of the Plutonic Rocks of Belgium," was read, and illustrated by some beautiful chromo-lithographs. The paper chiefly dealt with the question of temperature at which these rocks had been formed, and the conclusions deduced from the presence of crystals and fluids in the cavities assigned 307° C. as the probable heat at that period. The chairman expressed his great satisfaction that, by a totally different process of reasoning, M. Rénard had arrived at results so near to those which he had himself reached some years ago. The other papers read were, "On a New Slip for Mounting Opaque Objects," by Mr. M. Brock,—and "On the Markings of *Navicula rhomboides*," by Dr. J. J. Woodward. The latter was illustrated by a series of photo-micrographs which called forth the admiration of all who examined them.

MATHEMATICAL SOCIETY.

April 13th.—Prof. H. J. S. Smith, President, in the chair.—The Rev. Dr. Logan was proposed for election. Prof. Henrici, having taken the chair, the President gave accounts of a note "Sur un Théorème d'Eisenstein"; of papers, "On the Aspects of Circles on a Plane or on a Sphere"; and "On a Problem in Crystallography."—Mr. Tucker read part of an abstract (drawn up by Dr. Hurst) of a paper "On Correlation in Space," by Prof. R. Sturm.

PHOTOGRAPHIC SOCIETY.

March 14th.—The paper read by Captain Abney "On Photographing the Red Lines of the Solar Spectrum" was most interesting and important. It was shown that it is now possible, through the introduction of some gum resin into the collodion, to produce a negative of the least refrangible end of the spectrum.

SOCIETY OF BIBLICAL ARCHÆOLOGY.

April 4th.—Dr. S. Birch, President, in the chair.—The following papers were read:—"Ishtar and Izdubar; being the Sixth Tablet of the Izdubar Series," translated by Mr. H. F. Talbot. The following gentlemen took part in the discussion which ensued:—Messrs. W. Boscawen, J. E. Howard, R. Cull, Rev. A. Lowy, Prof. Donaldson, Rev. J. M. Rodwell, Rev. B. H. Cooper, Rev. T. M. Gorman, and Dr. Birch. "On the Tertiary Race," by the Rev. H. S. Warleigh. The following gentlemen took part in the discussion which ensued:—Dr. Birch, Prof. Seager, Revs. A. Löwry, J. Miller, T. M. Gorman, H. S. Warleigh, Messrs. E. B. Tylor, H. H. Howorth, G. B. Jenkins, Boscawen, E. R. Hodges, and P. Reed.

ANTHROPOLOGICAL INSTITUTE.

March 14th.—Col. A. Lane Fox, President, in the chair.—Mr. Stanbridge exhibited and presented a collection of stone implements from Australia. It consisted of some axe-heads, a mounted stone, spear-head, some Wallongs or grinding-stones, and a Yowiwi, a large flat stone implement, on which the Nardoo seed is ground; a large stone implement, supposed to be for digging, was also lent. The President considered this last was an unfinished tool, which would have been reduced in size if finished; but it had been used apparently in its present state, one of the ends being much rubbed. Capt. M. Campbell, President of Nevis, exhibited some stone implements; one of these a knife or dagger from Honduras, is 10½ inches long, and made of a thick flake of buff-coloured chert of a fine amber hue. Similar but smaller specimens from the same place are already in the Christy collection. Three polished celts from Turks and Caicoo Islands were shown by Capt. Campbell. Mr. H. H. Howorth read a paper, which was followed by a discussion. Mr. H. Dillon read a translation, by Capt. R. F. Burton, of two letters from H.B.M.'s Vice-Consul at Lissa, H. Topick, "On some Human and other Remains found recently in the Island of Pelagosa."

March 28th.—Col. A. Fox, President, in the chair.—Capt. H. Dillon exhibited a collection of flint implements and arrow-heads, recently found by him in the neighbourhood of Dytchley, Oxon.—Mr. E. B. Tylor read a paper "On Japanese Mythology." The legends current in Japan are derived from three sources; part belonging to imported Buddhism, part are taken from Chinese mythology, and the remainder, to the ethnological interest of which the present paper called attention, is of native Japanese origin. It contains nature myths of remarkable clearness, but distinct in their features from those of India, Greece, &c. Thus, the episode of the Land-forming-god, who springs from the *asi*, or flag which binds together the new-found marshy coast land of Japan, belongs to what is in fact geology expressed in mythic language. Again, the birth of the Sun-goddess, and her transference to the sky as ruler of Heaven, is followed by a graphic story of the visit paid to her by her brother, who is no doubt the personified Wind of Tempest, as he is described as mild and gentle when unprovoked, and always with tears in his eyes (*i. e.* rain); but when provoked be bursts into uncontrollable fury, uprooting trees and devastating the world. So, frightened with his violence, his sister, the Sun-goddess, retires into a cave in the sky, closing the entrance with a rock, and leaving the world in darkness. By the advice of the god of thought, a fire is kindled, and dances performed outside, and the sacred mirror and pieces of cut paper (*go-hei*) which still form the furniture of a Sin-to temple, are displayed. The sun peeps forth and is then pulled out altogether, and the cave closed. The whole episode is evidently a mythic picture of the sun hidden in tempest in the clouds as in a cavern, till she comes forth again to enlighten the world. A paper "On the term 'Religion'" was read by Mr. Distant. In the discussion which followed, Messrs. Satni Baba, Moncure Conway, Moggridge, B. Pusey, Jeremiah, and others, took part.

PSYCHOLOGICAL SOCIETY.

March 16th.—Mr. Serjeant Cox, President, in the chair.—Referring to a statement in the *Scotsman* newspaper, that Mr. Bruce (the owner of the emigrant ship, the Strathmore, which was wrecked in November last, with great loss of life) had been informed, by an alleged clairvoyant, of the wreck, and the saving of some of the crew on an island, at or near the time of its occurrence, and some weeks before the loss was known in England, the President said that, in pursuance of their plan of investigating all alleged psychological phenomena, he had written to Mr. Bruce, the owner, to inquire if this statement of the *Scotsman* was correct. He had received an answer from that gentleman (which he read) stating that the fact was as published. The fact was communicated in writing, by post, so that there was no question as to its being made before the loss was known. A paper, by Mr. C. Bray, "On Consciousness," was read by Mr. F. K. Munton, the Hon Sec., the writer attributing consciousness, as well as all mental perception, to molecular action of the brain, illustrating the law of the conservation of energy. A discussion followed, by Mr. Coffin, Mr. Pike, Mr. Gordon, the President, and others. It was stated that the Committee of Investigation had been formed.

ASIATIC SOCIETY.

MARCH 20TH.—Sir E. Colebrooke, Bart., M.P., President, in the chair.—Sir B. Ellis, Mr. C. Markham, and Mr. J. F. Browne were elected Members. A paper, "On the Form of Government under the Native Sovereigns of Ceylon," by Mr. A. de Silva Ekanâyaka, was read.

FOREIGN SCIENCE.

AMONGST the features which strike the English reader in turning over the pages of books and magazines is the quickness with which foreign (English and American) experiments and discoveries are repeated and commented upon; the attention paid in America to science prevails to a greater extent than in this country, and the exact learning displayed is almost indeed geometrically exact. This is a good habit, which we take it upon ourselves to recommend to our readers.

Before entering upon a brief diagnosis, an interesting fact in natural history is worth mentioning, as it is also curious. It appears that the migrations of birds were much more considerable at the commencement of this winter than usual, described by a very authentic work as a most infallible sign of a long and rigorous winter, for these voyages are executed "with regularity and following invariable laws." The cold of winter is found to be severer in proportion to the additional number of emigrants. It appears that we have received additional emigrants from cold countries, which may gratify the sportsman, but will hardly please the inhabitants of this country generally, obtaining for them in ornithology such a character as *alieni appetens sui profusus*.

THE SUBMARINE RAILWAY BETWEEN FRANCE AND ENGLAND continues to engage a great deal of attention. The direct tunnel, to set out from the English coast, near St. Margaret's Bay, presents a submarine length of 28 kilometres. The report to the Assembly bears out that the work is possible, if not easy. The objections are, the length of the submarine part, the difficulties of access, air-supply, conveyance of materials, which will impose more than one rude problem upon the inventive spirit of the engineers. The misfortune is that geology cannot in a completely perfect way satisfy the difficulties connected with the query, whether the bed of gray chalk be compact and homogeneous. The occurrence of some at the summits of mountains anterior to the clay is said to be possible. It seems that the enterprise cannot be considered practicable until deep searches and soundings are made upon the two coasts of the Straits; if the indications turn out good, to open an experimental gallery from one side of the strait to the other. Until this work be accomplished there can be no legislation. The principal points of the Company's programme are—the tunnel will present in the centre a slightly arched part, having its point culminating towards the middle of the Straits, at 300 feet downwards of the bed of the sea, and descending towards the banks by incline falling gradients. From two extremities of the central part, the English and French banks will be regained by two passages of eleven kilometres in length. The submarine railway will be in unison with the South-Eastern and Chatham and Dover and the Compagnie du Nord. In prolongation of the central part there will be two small section galleries to conduct the waters to the pools upon the coasts, where machines will take them and carry them to day-light. It appears that generally the employment of falling gradients will be very acceptable.

A NEW STEAM-ENGINE, which has excited a good deal of attention, is the engine invented in view of the realization of a rapid rotation, by M. Ursène Olivier, and called by him the Rotator. This furnishes as great a number of turns of the driving shaft as action takes place without the intermediation of gear and with limited piston speed. Small volume and lightness are features. "The driving shaft being fortified with two filed parts in an inverse sense, and bearing a nut on each of those parts; if those nuts receive an alternative movement by the fact of their connection with the drafts of a piston, each of them will be capable of impressing a rotatory motion upon the driving-shaft, if it be itself wedged upon the conducting-shafts proceeding from the piston, whilst it could traverse a certain number of springs of the shaft without modifying the state thereof; if it is 'fou' by relationship to the conducting shafts. It follows that to realise the continuous rotation of the shaft it suffices that one of the nuts being wedged up for the departure of the shaft of the piston, the other is 'ready,' and inversely that the second nut 'being ready' for the departue of the shaft is wedged up in return. For the rest, the rotation of the shaft will be produced in one sense or another, as the two nuts shall be wedged up in order, or inverse order, whence the possibility of changing motive progress."

However, the realization of the idea comprises several methods. The account given is so full and interesting that we may possibly publish an entire translation in a future impression.

M. TH. DU MONCEL has recently instructed the Academy upon the effects of electrical polarisation in certain minerals, under the influence of a traversing current, the result of a great deal of work upon the conductibility of bodies moderately conductive. The stone furnishing the most considerable effects is a grey silex, which is met with in the middle of the calcareous stone quarries of Heronville, near Caen. To have a glimpse of its value we are obliged to unite the two extremities of the cord of the galvanometer by a cord of derivation of a resistance of 4 kilometres only. In these conditions the deviation of the galvanometer still attains 75° at the end of ten minutes. These effects resemble those connected with submarine cables, known as electrification.

We would like to direct attention to the new electrical experiences of Mons. Stroumbo, Professor of Athens University, connected with the electrophore. The amount of study which electricity enjoys amongst a wide class of *savants* of *actually different pursuits*, all over Europe just now is very great; we hope it may be to good purpose, for, considering also the amount of past study, we had almost a right to expect more results in practical use than already obtained.

M. DECHARME, writing upon new sonorous flames, says: "In the production of sonorous flames by insufflation the part of the air is more chemical than mechanical; the sound results from little explosions, which are produced incessantly at the time of the combination of the oxygen of the air with the hydrogen or the carbon of the flame in incomplete combustion; and in order that it may have its product, the presence of the air or of an inert gas mingled with oxygen seems necessary, at least in order that the sonorous phenomenon may be well marked or pronounced."

There are *still abundant gaseous discharges at the Island of St. Paul;* analyses have shewn that carbonic acid, oxygen and azote, with a more or less great quantity of water vapour, disengage themselves in proportions which remain sensibly fixed for each *fumerille*, but varying with each. We are indebted for much of the above particulars to the papers in our contemporary *Les Mondes*, edited by the Abbé Moigno; especially those in the number for March last.

In regard to hydrogen, and relatively to the progress of the chemical arts during the past ten years, one important modification has been introduced in practice, since they have no need of a vapour heater for the fabrication of water gas, and so economise the combustible, reducing at the same time the usury of the simplified appliance. The oil is warmed with soda, nitrate of chalk, or barite, in the fire; and so they decompose the water combined with these bases, which is then disengaged from the carbonic acid in the ordinary manner. The Oxygen Company of New York thus sells water gas at two cents the cubic foot.

In burning calcium in the bosom of the electrical arch to analyze spectrally its incandescent flame or vapour, Mr. Norman Lockyer has demonstrated that if the temperature of the arch be sufficiently modified the spectre of the metal will present rays which characterise it, but that if the temperature of the arch is sufficiently raised, two violet rays are seen appearing characteristic of hydrogen. Calcium would tend then to resolve itself into hydrogen.

Observations of temperature have been made at the Museum during the meteorological year 1875, with electrical thermometers placed under the ground, varying from one to thirty-six metres. It appears that these observations are made daily with great exactness both above and under ground. We mentioned before the extraordinary ways in which electricity is being and is likely to be used througthout the world, and this is only a minor instance. Those easy-going members of the public, who have been simply accustomed to a little ornamental standing thermometer on the parlour mantel-piece, or an equally small one hanging in the hall, can hardly imagine that the under ground observations are made by means of a thermoelectrical cable composed of seven different circuits, portions of which are placed each five in five metres, penetrating into a well. The first is at six metres, the last at thirty-six metres. Another separated cable gives the temperature at one metre of depth. It appears that within recent years the temperature has become rather warmer, observable merely in a greater number of days of medium temperature.

We would call attention to a report by M. Paliard on the scaffolds of M. Bomblin. The moveable scaffolds, borne on wheels, mounting and dismounting easily, are contrived to facilitate the reparation and cleaning of the interior of grand constructions; for example, the naves of churches or temples, and grand vestibules or passages. We are chiefly accustomed in England to the scaffolds reaching from the ground or small flying ones for painting purposes, some of which latter were in use the other day in

Fleet-street. The moveable scaffold of M. Bomblin mounted on wheels is three metres broad, upon 3.50 long, and five of height. A platform which receives the workmen forms a crown, and it can, by means of coulisses, be elevated at 9m. 46 of height, which, with the height of the workmen, permits a height of 11m. 50 to be attained.

Ladders are disposed upon one of the sides, and they admit of a balcony being established for executing the painting of mural parts, 3m. 50 in length, upon 0m. 70 in breadth, which can be elevated from 0m. 22 to 4m. 78, so that the workmen can reach the height of 6m. 78. By a moveable balcony the vertical faces of walls are to be painted. They have also the advantage of allowing artists painting frescoes to withdraw to 5 and 6 metres to be able to judge the effect better which they produce.

An apparently useful association exists in France called the Society for Encouragement of National Industry; which is perhaps more active than any association bearing in that direction which we possess. A member of it, M. Deanville, ainé, an agriculturist, at Petit Bourg (Seine-et-Oise), on account of the land in cultivation of grapes and beetroot labouring in vapour during the rainy season, has invented a little iron moveable railway, with four-wheeled waggons. For the preservation of meat, at Buenos Ayres, dissolved borax has recently been used very successfully. M. Comsin-Bordat, struck with the disadvantages of chlorium in excess, has invented a better form of bleaching at his works, Saint Denis, based upon rational and successive reactions, which is very successful. This is accomplished by a discolouring paste, which is so strong, that not only cotton and linen, but also the most refractory organic matters, are bleached in a few hours. Our worthy contemporary, *Les Mondes*, is not able to give particulars of the said paste.

RECENT AMERICAN INVENTIONS.

Spring Motor.—Edwin Lampkin, Sebewaing, Mich.—This is an improved spring power for running street cars, railroad hand cars, road vehicles, and driving machinery. The invention consists in the peculiar construction of a spring drum, and in means for applying a brake and operating a shifting mechanism, the whole of novel and ingenious construction, but hardly possible to explain clearly without the aid of drawings.

Hay Raker and Loader.—George Lambert, Hill Grove, O.—This is a new machine for gathering hay and loading it upon a waggon in a compact form. The hay is elevated by an endless apron having cross bars and swinging arms with spikes to collect the hay. Guides raise the arms from a horizontal to a vertical position as the apron lifts the hay, thus compressing the same.

Gang Plough.—Enoch C. Eaton, Pinckneyville, Ill.—This invention includes several new and ingenious devices by which the ploughs can be readily adjusted to work deeper or shallower in the ground, which will hold the plough from lateral play when at work. Suitable new arrangements also enable the ploughs to be easily raised from the ground.

Guano Distributor.—Richard A. Barrett, Newsome Depot, Va.—This relates mainly to combining with the distributing cylinder an axle having long journals, frame bearings, flanges, and nuts. When nuts are screwed up, the distributing cylinder is compelled to turn with the axle; but when the nuts are loosened, the weight of the distributor will hold the axle still while the wheels revolve upon its journals.

Refrigerator Car.—Arnold W. Zimmerman, Denison, Tex., assignor to Samuel Pillsbury, New York City.—This inventor has devised a new refrigerator car for preserving fresh meats, vegetables, and other perishable articles while transporting them over great distances. There is an ice receptacle at the top of the car, provided with flat top and curved and inclined bottom. Above the ice receptacle an air space is formed, that communicates, by side spaces, with the main part of the car, for conveying the warm air and vapours to the ventilators above the air space. The condensed moisture is collected by a longitudinal inclined trough below the lowest part of the ice receptacle, to be conveyed to the outside. The ice water of the receptacle is drawn off by end pipes and stop cocks.

Spark Arrester.—Royal P. Faries, Wichita, Kas.—This consists of a wire netting section in the smoke stake for the escape of the smoke. The cinders are allowed to pass above into a trap formed by a close cover over the pipe and a contraction of the top of the latter, from which they are conducted back into the smoke arch through pipes passing down the side of the smoke pipe through the saddle.

Scholar's Companion.—William A. Harwood, Brooklyn, N. Y.—The object of this invention is to provide for the use of school children a pocket companion or case for pencils, pens, etc., which shall possess a shape best adapted to enable it to withstand the rough treatment to which it will ordinarily be subjected in actual use, and to prevent rapid wear of the pocket in which the case is carried. The box is formed of a single sheet of tin, bent to form round sides, the bottom being nearly flat. The ends are formed of separate pieces of conical forms, and are fastened on said body so as to inclose its ends. The cover is a mere strip of tin with parallel edges, and is fitted to slide forward and backward in grooves.

Implement for Forming Barbs on Wire Fences.—James H. Hill and William H. Jayne, Boone, Iowa.—This is an improved implement for forming barbs upon the wires of a wire fence easily and quickly, and in such a way that the barbs will retain their places securely. By suitable construction the barbs are firmly twisted around each other and around the fence wire.

Hair Restorative Composition.—Mrs. Anness R. Kinyon, Downer's Grove, Ill.—This improved restorer consists of extract of wild grape vine, with which is combined salt and castor oil, to cleanse and heal and prepare the scalp for the restoring properties of the grape vine. The alcohol is combined in sufficient quantity to cut the oil and keep the preparation sweet.

Extensible Frame for Window Screens, &c.—John R. Simpson and G. W. Simpson, New York City.—This improved frame, though designed especially for a fireboard frame, may be used for a window screen frame. It is so constructed that it may be readily expanded and contracted, to adjust it to fireplaces and windows of various sizes.

Boiler Tube Stopper.—Peter Walker, Jersey City, N.J.—This consists of a spring packing ring and a clamp for expanding it for each end of the boiler tube. The clamps are formed of a collar on each end of the tube. Other collars on a rod pass through the tube, and are fixed so as to clamp and expand the packing rings tightly into the tubes of the boiler. The rod and tube of the stopper are of suitable length to fasten the packing rings into the tube at the ends. A stopper of this kind can be put into a locomotive or marine boiler, by the aid of suitable tools, without stopping the fire.

Dumping Waggon.—Jacob Kramer, New York City.—This is a dumping waggon, having the seat mounted upon the front truck, and the body hinged at or about the middle thereof to the rear axle, whereby the rear axle bears the greater part of the load, and the body turns clear of the seat.

Whiffletree.—Remus D. Hale, Transitvilla, Ind.—This consists of a dovetail-shaped projection on the underside of the whiffletree sliding into a corresponding grove in the top of a stud pivoted in the evener, and fastening by a snap spring, so as to be easily and quickly connected and disconnected.

Coffee Pot.—Louis C. Lomer, New York City.—In this coffee machine a liquid-holding vessel (provided with an internal arrangement of strainers and a discharge pipe leading from the bottom thereof) is supported in or upon a detachable stand or pedestal. The improvement relates particularly to the construction of the stand, which has semi-circular hinged covers, which are left open while the alcohol is burning, and closed to extinguish the flame.

Ironing Table.—John L. Young, Foxburg, Pa.—To this improved ironing board the shirts may be readily applied, and then securely retained in stretched state for ironing. There is a dovetailed recess at one end, to which the collar band is attached by a fastening key, and also a dovetailed stretching block, to which the lower part of the bosom is keyed. The block is guided in the recess at the opposite end of the board by a projecting bottom edge, and locked to the ratchet teeth of the recess.

Boiler Washing Machine.—William B. Rodecker and Frank C. Pifer, Eureka, Ill.—This invention relates to the arrangement of parts, whereby the clothes are turned in the cylinder and prevented from becoming packed too closely against the sides thereof; also, whereby the cylinder is held in the middle of the boiler.

PATENT FOR INVENTIONS BILL, 1876.

In committee of the House of Lords the following alterations were made in this Bill:—Clause 9. Examination to take place on *Notice to Proceed*, instead of, as originally, on request of applicants; in clause 11, the reference to law officer is required to be preceded by a notice to further proceed; in clause 12, another notice to further proceed required before application can progress to warrant and sealing; clauses 13, 14, 15, the request for sealing still required.

APPLICATIONS FOR LETTERS PATENT.

On February 3rd (*Continued from page* 66).—J. C. Peacock. Ovens.—G. H. Chubb. Safes and strong rooms.—J. Groves, jun. Sawing machinery, applicable especially for sawing deals into boards.—A. P. Sharp and T. Smith. Life-saving apparatus to be fitted on board ships' boats for use at sea.—J. J. Snow. Machine to travel along a line attached to a kite or any high point and carrying up and dropping any material placed thereon, the machine returning to the hand.—J. Harrington. Wheel skates.—W. R. Lake. Horse-shoes (com.)—J. Broadhead. "Jacks" and jack-hooks of jacquard apparatus.—E. T. Hughes. Shuttle spindles (com.)—A. M. Clark. Machinery for reducing or pulverizing ores and other hard substances, applicable also for other purposes (com.)—W. R. Lake. Revolving cylinder pistols (com.)

On February 4th.—446 to 465.—C. W. Spurr and L. Prang. Veneering, and manufacture thereof, for the ornamentation, in imitation of marquetry, of furniture, or various other matters. (Complete specification.)—J. Dale. Convertible seats, desks, tables, and such like.—W. Henman. Hanging of window sashes.—J. Kite, sen., and J. Kite, jun. Roller skate.—A. Moleux. Process of illuminating the projectile of life-ropes projecting guns.—J. Kershaw. Shuttles and loom for weaving.—J. Mackie. Machine for drawing or thinning plants sown or planted in drills or otherwise.—A. Burdett. Construction and arrangement of machinery for compressing air, partly applicable to other purposes. F. Wirth. Woven fabrics (com.)—W. G. Colechin. Railway signals.—F. Wirth. Method of and apparatus for raising liquids, blowing air, propelling ships, kneading doughy masses, forwarding grain, and other like purposes (com.)—S. Johnson. Apparatus for washing and disintegrating clay, also applicable to other purposes.—J. Bullough. Looms for weaving.—J. Thomas. Machinery or apparatus for weighing small coal, liquid, or other matter at collieries or elsewhere, and for other like purposes.—D. Sival. Mechanical regulator applicable to several purposes.—W. R. Lake. Lamps for hygienic purposes (com.)—G. Barclay Bruce, jun. Apparatus for transferring passengers and carriages over rivers, estuaries, and valleys.—D. Young. Apparatus for exhibiting and copying pictures by the oxy-hydrogen or other such light, partly applicable to making oxygen gas for other purposes.—T. J. Smith. Means and apparatus for setting or regulating calendar watches.—S. Jackson. Glass mirrors, applicable to glass facias, sign tablets, and other similar articles (com.)

On February 5th.—466 to 480.—A. C. F. Franklin. Wheel or roller skates.—E. H. Baxter. Call bell, partly applicable to other bells.—C. Toussaint. Bleaching cotton on shuttle cops, bobbins, or in hanks.—P. Joannès. Machine for corrugating, fluting, or indenting iron wire not annealed, for the manufacture of diamond-shaped lattice or trellis work.—P. Kirk. Rolling mills employed in the manufacture of iron and steel.—J. C. Mewburn. Machinery for spinning, twisting, or doubling fibrous materials (com.)—G. Tidcombe and C. Heaton. Apparatus employed in the manufacture of paper.—P. Barrie and W. Samson. Internal stoppers for aërated water bottles.—W. Lee. Apparatus to be applied to street cars or omnibuses to register the number of passengers carried, partly applicable for other counting and registering purposes (com.)—S. Abbott. Couplings for railway vehicles.—S. Crabtree, T. Crabtree, and J. Crabtree. Furnaces for steam boilers and water heating apparatus.—A. M. Clark. Fountain (com.)—G. Lowry. Construction of radial arm drilling and slot drilling machines.—M. Mirfield. Machinery or apparatus for combing wool or other fibrous substances.—S. O. Brown. Wheel or roller skates.

On February 7th.—481 to 494.—L. Jordan. Pumps and beer-engines.—P. M. Parsons. Metallic alloys.—H. J. Haddan. Solar chronometers (com.)—G. Tucker.—Kilns for drying and burning bricks, tiles, terra cotta, sanitary pipes, and other pottery ware, lime, and cement, and for salt glazing.—H. M. Thomas. Roller skates.—J. Townsend. Steam-boiler and other furnaces.—J. Phillips. Mortising machines.—H. Lawrence. Rollers, drums, and sheaves for waggon ways and other purposes.—J. H. Small. Tramway cars and omnibuses.—A. J. Dobson and R. Cook. Springs for railway-carriages.—J. H. Johnson. Lubricating packing for stuffing-boxes and other like purposes (com.)—C. W. Harrison. Application of magnetism for the promotion, restoration, and preservation of health.—W. Powell. Breech-loading small-arms.—J. Watson. Manufacture and ornamentation of the handles of umbrellas, parasols, sunshades, walking-sticks, and other like articles.

On February 8th.—495 to 510.—C. Kingsford. Artificial fuel blocks.—W. R. Davison. Fire-bars and appliances for saving of fuel and the better consumption of smoke. — C. Mason. Valve apparatus for steam pumps and other purposes.—A. M. Torrance. Numerical marking of piece goods and other materials and fabrics sold by length and apparatus therefor.—F. W. Köftgen. Pumping engine. — F. L. Hill. Tobacco pipes.—A. Mullord. "Satining" or impregnating with certain substances, tissue and other paper.—P. F. Boisseau. Apparatus for inspecting and cleansing the bottom of ships, pier walls, and other submerged structures.—H. Macaulay. Rink skates. — B. Fawerkamp. Desk benches for school use.—W. R. Lake. Apparatus for transmitting and registering fire and burglar alarm and other signals (com.)—W. R. Lake. Lubricating apparatus for steam engines (com.)—W. Bevis. Roller skates.—A. V. Newton. Centrifugal pumps (com.)—D. Brodie. Apparatus to be used in mashing grain and other matters, and in heating water and other liquid by means of steam.—H. J. Lloyd. Packing tobacco for sale.

On February 9th.—511 to 528.—J. Furey. Back sights of rifles and other guns.—G. Haycraft. Manufacture of ammunition for ordnance.—C. Smith. Arrangement for filling lamps and other vessels and for indicating the height of fluids therein (com.) (Complete specification.)—J. H. Johnson. Apparatus for transmitting power and motion and multiplying speed and power (com.)—E. F. Piers. Apparatus for signalling on railways and stopping railway trains.—J. E. Dooley. Taps for steam or hot fluids.—F. W. Mackenzie. Drying tea, and apparatus connected therewith.—S. Johnson. Machinery for indicating the distance travelled by vehicles.—R. Free. Kilns for drying malt, hops, grain, and other produce (partly com.)—G. Zaffira. Watches, clocks, and chronometers. — W. Garrad. Manufacture of coffin handles, door and other handles, manger rings, door knockers, and other like articles.—H. Moore. Anti-friction rollers, cylinders, wheels, or spheres for the diminution of friction in bearings for various useful purposes, such as for skates, castors for furniture, and journals and gudgeons for machinery, and other similar purposes.—C. McG. Bate. Roller skates.—W. R. Lake. Galvanic batteries (com.)—P. Jensen. Apparatus for composing and distributing type (com.)—G. G. Bussey. Pneumatic pistols. (Complete specification.)—T. Christy. Roller skates (com.)—F. H. Smith. Lamp wicks.

On February 10th.—529 to 548.—A. B. Brown. Machinery for cutting stone.—T. S. Hunter. Battery for purposes of attack and defence.—J. Huntington and W. Cadman. Machinery for the manufacture of marbled papers.—H. A. Bonneville. Flooring (com.) (Complete specification.) — H. A. Bonneville. Process for treating zinc ores and all other matters containing zinc (com.)—W. F. Lotz. Portable hand or pocket lanterns (com.)—H. E. Taylor. Apparatus for washing, separating, and sizing mineral and other substances.—A. M. Clark. Treadle mechanism for operating sewing and other machines (com.)—A. J. Aspinall. "Sliding boxes" for holding and containing matches and other articles.—J. Jobson. Stoves or fire-places.—W. L. Jackson. Leather rolling machinery.—A. Parkes. Treating nickel ores and alloys.—P. Kershaw. Apparatus to be used as breaks for stopping railway trains or carriages.—G. Lowry. Roller or rink skates. (Complete specification.)—W. Conquest. Apparatus for folding paper (com.)—G. Lindemann. Construction of street tramways.—W. Tytherleigh and E. Nash. Construction of skates.—J. A. Mays. Facilitating locomotion by applying to all or some of the wheels of road or portable engines, carriages, carts, velocipedes, roller skates, castors of furniture and other vehicles or apparatus having running or traction wheels not working upon fixed rails or tramways with guides to the same and by making certain arrangements or combinations of running or traction wheels to be used with a travelling tramway.—W. B. Smith and J. Starley. Wheel or roller skates.—W. R. Lake. Neck-ties (com.)

On February 11th.—549 to 566.—T. Duncan. Belting for driving machinery.—A. Fryer. Method of and apparatus for treating street sweepings, urine, and other refuse of towns, the apparatus being also partly applicable to other analogous purposes.—W. Worthington. Fog signals.—W. Westly. Fly spindle stud in looms for weaving.—P. R. de F. d'Humy. Manufacture of ornamental or other articles from glass, clay, terra cotta, cements, and other substances which admit of being moulded into various forms while in a plastic state.—E. G. Brewer. Cases or receptacles for toilet and other articles (com.)—N. Ager. Locks or fastenings, especially applicable for railway and other carriages.—A. L. Smith and H. A. Smith. Railway wheels.—E. Tyer. Means and apparatus for effecting electrical communication in railway trains.—W. P. Cherry and C. E. Cherry. Alarm signal apparatus for the prevention of collisions on railways.—J. McLintock and J. W. Brown. Roller skates.—A. Budenberg. Steam pressure vacuum and other guages (com.)—W. R. Lake. Rotary engines (com.) (Complete specification.)—H. Bray. Production of gas for illuminating and for heating purposes.—G. Magnus. Manufacture of billiard balls and similar objects.—J. Ruch. Process for extracting precious metals contained in the ingots, the ores, the matts, the goldsmith and silversmith ashes, the wastes of all kinds, and also in the residues of the amalgamation.—J. de Kinder and F. C. Latour. Steeping or retting of flax, hemp, and other textile materials, the separation of their fibres, and the bleaching, calendering, and otherwise treating the same and the fabrics made thereof. J. Coats, jun. Machinery for doubling and twisting yarn and thread.

On February 12th.—567 to 589.—H. J. Haddon. Machines for distributing type (com.) (Complete specification.)—G. K. Stothert and E. J. Curtin. Low water for steam boilers and other receptacles for liquid under pressure.—J. H. Vince. Compound for lubricating wool during the process of carding.—G. Friend. Skates.—G. Temple. Buffers and springs employed in connection therewith; partly applicable to similar purposes.—T. Reynolds. Pneumatic apparatus for extinguishing fires; also applicable to other purposes (com.)—J. C. Cole. Machines for breaking, crushing, and grinding stones, ores, minerals, and cements.—D. McGill. Couplings for railway carriages.—William Shepherd and W. Maxwell. "Tell-tale," or apparatus for checking workmen's time in public works.—B. Krocker. Equilibrium valves.—M. H. Pearson. Sewing machines.—J. Scharr. Composition to be used as a substitute for oil in the preparation of wool for spinning and other manufacturing purposes.—J. J. Lesware. Roller skates.—H. Kerr. Envelopes.—W. Hall. Machinery for twisting and doubling silk and other fibre.—W. R. Lake. Loading and firing of heavy ordnance, governing the recoil of the same, and cartridges therefor (com.)—J. W. Brown. Kitcheners and other cooking ranges.—J. Sheldon and W. C. Stiff. Roller skates.—J. Johnson and R. Wayne. Breech-loading small-arms.—T. E. Wilson. Apparatus for heating and drying.—J. Patterson. Machines for stamping minerals, metals, animal and vegetable substances, and textile fabrics and fibres, partly applicable to springs for carriages, power hammers, and other purposes.—J. Atkinson and T. Temple. Means of communication from signal cabin to engine driver and guards of a railway train.—W. R. Lake. Apparatus for ventilating railway carriages, houses, ships, and other buildings or structures (com.) (Complete specification).

On February 14th.—590 to 606.—J. Palmer. Window fastening applicable to sliding doors and sashes generally.—E. Hamer, J. Metcalfe, and E. Davies. Feeding locomotive and other steam boilers or generators, applicable also for raising and forcing water for other purposes.—H. Batt. Construction of scaffolding used in the erection of buildings.—G. Duncan. Machinery or apparatus for finishing printed sheets of paper.—J. Clayton. Apparatus or appliances to be used in athletic sports or games.—G. Whight. Steam whistles (com.)—P. A. V. le Lubez. Grinding pepper box or caster (com.)—G. King. Machinery for the manufacture of cut nails and tacks.—H. Dyer. Manufacture of pulp for paper.—J. Curren. Construction of electric indicators.—T. Southgate and J. Woodward. Breech-loading fire-arms.—W. Clark. Indicators for the slide-valves of steam-engines.—H. A. Burgess. Roller skates.—T. G. Webb. Apparatus for feeding furnaces.—G. Collier. Machinery or apparatus for painting laths for Venetian blinds, applicable also to painting other thin strips of wood or metal.—T. Archer. Mill for crushing bones or other substances, such as oil cakes.—T. Blackburn. Method of securing the ends of bands for driving the spindles of spinning frames or other machines.

It is announced that the Scientific Loan Exhibition at South Kensington will be opened by her Majesty the Queen in person, on the 13th of May.

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